

The McGraw-Hill Companies

Massage Therapy Series

STRUCTURAL BALANCING

A CLINICAL APPROACH

Kyle Wright

Mc
Graw
Hill

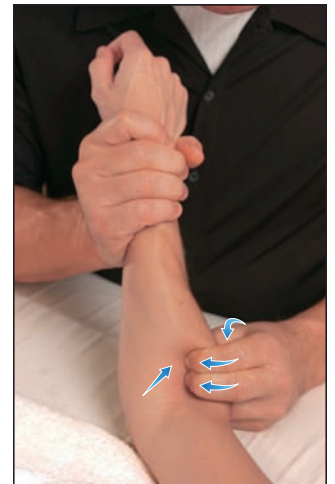
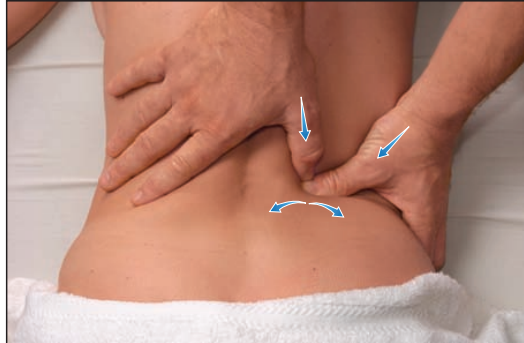
Connect
Learn
Succeed™

STRUCTURAL BALANCING

A Clinical Approach

Kyle C. Wright, LMBT, NCTMB

North Carolina School of Advanced Bodywork
Asheville, North Carolina
www.ncsab.com





STRUCTURAL BALANCING: A CLINICAL APPROACH

Published by McGraw-Hill, a business unit of The McGraw-Hill Companies, Inc., 1221 Avenue of the Americas, New York, NY, 10020. Copyright © 2011 by The McGraw-Hill Companies, Inc. All rights reserved. No part of this publication may be reproduced or distributed in any form or by any means, or stored in a database or retrieval system, without the prior written consent of The McGraw-Hill Companies, Inc., including, but not limited to, in any network or other electronic storage or transmission, or broadcast for distance learning.

Some ancillaries, including electronic and print components, may not be available to customers outside the United States.

This book is printed on acid-free paper.

1 2 3 4 5 6 7 8 9 0 DOW/DOW 1 0 9 8 7 6 5 4 3 2 1 0

ISBN 978-0-07-337392-8

MHID 0-07-337392-3

Vice president/Editor in chief: *Elizabeth Haefele*

Vice president/Director of marketing: *John E. Biernat*

Publisher: *Kenneth S. Kasee Jr.*

Senior sponsoring editor: *Debbie Fitzgerald*

Developmental editor: *Connie Kuhl*

Marketing manager: *Mary B. Haran*

Lead media producer: *Damian Moshak*

Media development editor: *Marc Mattson*

Director, Editing/Design/Production: *Jess Ann Kosic*

Project manager: *Marlena Pechan*

Senior production supervisor: *Janean A. Utley*

Senior designer: *Srdjan Savanovic*

Digital production coordinator: *Brent dela Cruz*

Senior photo research coordinator: *John C. Leland*

Cover design: *Daniel Krueger*

Cover image credit: © CORBIS

Typeface: *13/16 Adobe Jensen Pro*

Compositor: *Laserwords Private Limited*

Printer: *R. R. Donnelley*

Credits: The credits section for this book begins on page 371 and is considered an extension of the copyright page.

Library of Congress Cataloging-in-Publication Data

Wright, Kyle C.

Structural balancing : a clinical approach / Kyle C. Wright.

p. ; cm.

Includes bibliographical references and indexes.

ISBN-13: 978-0-07-337392-8 (alk. paper)

ISBN-10: 0-07-337392-3 (alk. paper)

1. Massage therapy. 2. Musculoskeletal system. I. Title.

[DNLM: 1. Musculoskeletal Manipulations—methods. 2. Massage—methods.

3. Musculoskeletal Diseases—therapy. 4. Posture—physiology. 5. Soft Tissue

Injuries—therapy. WB 535 W951s 2011]

RM721.W884 2011

615.8'22—dc22

2009025161

The Internet addresses listed in the text were accurate at the time of publication. The inclusion of a Web site does not indicate an endorsement by the authors or McGraw-Hill, and McGraw-Hill does not guarantee the accuracy of the information presented at these sites.

DEDICATION

To my sons, Steele Christopher and Ethan Clarke, and my daughters, Carley Anne and Reagan Alee, for their unconditional love, patience, and motivation for continuing my education.

To all the students whom I had the privilege of teaching and learning from and to the many instructors of massage therapy who share their knowledge and expertise in their classrooms.

—Kyle C. Wright

ABOUT THE AUTHOR

Kyle Wright is the founder and president of the North Carolina School of Advanced Bodywork, Inc., located in the quaint town of Fairview, North Carolina, a suburb just 10 minutes southeast of Asheville, North Carolina. His new school's curriculum and health care facility is devoted to the treatment and ongoing clinical research of postural-related problems, muscular imbalances, and myofascial pain.

As the primary hands-on instructor of functional anatomy, kinesiology, soft-tissue pathology, and clinical treatment strategies, Kyle also maintains a private practice at the North Carolina School of Advanced Bodywork and offers regular continuing education seminars for the National Certification Board for Therapeutic Massage and Bodywork. He teaches a variety of postgraduate training courses to further educate licensed therapists in the evaluation and treatment of structural imbalances and musculoskeletal pain.

Kyle's North Carolina School of Advanced Bodywork's curriculum was initially developed in 1991, when he cofounded his first of five Southeastern Schools of Neuromuscular and Massage Therapy, Inc., in Jacksonville, Florida. There he developed the clinical and practical portion of the clinical massage therapy and structural bodywork curriculum. Kyle wrote and self-published the manual *Clinical Neuromuscular and Structural Bodywork*, which served his former students of the Southeastern Schools for the past 15 years.

He also cofounded the Southeastern Schools of Neuromuscular and Massage Therapy, Inc., in Charlotte, North Carolina, and in Greenville, Charleston, and Columbia, South Carolina. In 2005 two of his schools were awarded School of Distinction Awards by the Accrediting Commission for Career Schools and Colleges of Technology (ACCSCT).

In 2007, after selling the Southeastern Schools to Keiser Career Colleges and two Wright Centers of Advanced Bodywork practices to his loyal and long-standing therapists of 20 years, Kyle shifted his energy to fulfill his dream of living in and operating his new school in the health- and wellness-minded area of western North Carolina.

Kyle graduated in 1984 from the Suncoast School of Massage Therapy, Inc., in Tampa, Florida. He had the privilege of learning from and assisting Paul St. John,



LMT, in the instruction of the St. John Seminars from 1986 through 1991 while maintaining his practice at the Jacksonville Neurological Clinic for 6 years. Kyle went on to work at the North Florida Center for Head, Neck and TMJ, assisting the physician's patients by normalizing the soft-tissue components of the body, thus reducing many of the afflictions associated with temporomandibular disorders.

In 1988, Kyle opened up two Wright Centers of Advanced Bodywork in Jacksonville and Ponte Vedra Beach, Florida, becoming one of the first providers of clinical bodywork in the community. His vision still lives today as the Wright Centers are successfully operating after 22 years.

For his entire career Kyle's commitment to the field of bodywork has helped further his studies; he has worked in conjunction with many physicians specializing in neurology, orthopedics, podiatry, radiology, chiropractic, and dentistry. He has also worked with many of the industry greats in athletic training and physical therapy and with many nationally renowned massage therapists. He served as an instructor on the teaching rotation of the Complimentary/Alternative Medicine (CAM) curriculum at the University of North Florida in Jacksonville, Florida. There he taught proper posture, myofascial imbalances, and their relationship to musculoskeletal pain.

Kyle maintains a unique relationship with many of the worlds' top professional golfers playing on the PGA and European tours. When traveling and working with the players, his treatment strategies include cardio training, light workouts, and stretching before their tee times and massage and bodywork in the evening to enhance their peak performance.

Kyle was honored to be selected as Massage Therapist of the Year by the Florida State Massage Therapy Association in the North Florida Chapter in 1992.

He has been a speaker at:

- *The National Convention for Osteopathic Medicine*
- *The Florida Chiropractic Convention*
- *The Florida State Massage Therapy Convention*
- *The Mayo Clinic, Physical Therapy Department, in Jacksonville, Florida*
- *National certification courses for strength and conditioning coaches and trainers*

Kyle is a 20 year member of the American Massage Therapy Association and Florida State Massage Therapy associations.

BRIEF CONTENTS

WELCOME CHAPTER: THE VALUE OF SOFT-TISSUE THERAPY	1
SECTION I: Foundations	7
CHAPTER 1: COMPONENTS OF STRUCTURE: BONES AND LANDMARKS	8
CHAPTER 2: STRUCTURAL ANALYSIS AND POSTURAL ASSESSMENT	32
CHAPTER 3: MUSCLE TENSION AND CAUSES	58
CHAPTER 4: SYMPTOMS AND CONDITIONS OF MUSCLE TENSION	81
CHAPTER 5: PRINCIPLES OF REVERSING MUSCLE TENSION	96
SECTION II: Clinical Massage Therapy and Structural Bodywork	119
CHAPTER 6: POSTERIOR LOWER-EXTREMITY COMPARTMENT (PLEC)	120
CHAPTER 7: ANTERIOR TORSO COMPARTMENT (ATC)	164
CHAPTER 8: ANTERIOR LOWER-EXTREMITY COMPARTMENT (ALEC)	218
CHAPTER 9: POSTERIOR TORSO COMPARTMENT (PTC)	257
CHAPTER 10: UPPER-EXTREMITY COMPARTMENT (UEC)	311
Appendix A: Muscles of the Body	346
Appendix B: Receptor Tonus Principles and Neurophysiologic Laws	361
Appendix C: Agonist, Synergist, and Antagonist	362
Appendix D: Chiropractic and Massage: Symbiotic Health Care (Dr. Kelly Huber)	363
Appendix E: The Mind-Body Connection (Robert J. Rotella, PhD)	367
Appendix F: Proper Stages of Rehabilitation of Injured Soft Tissues	368
References and Resources	369
Credits	371
Glossary	373
Index	379
Muscle Index	385

CONTENTS

WELCOME CHAPTER: THE VALUE OF SOFT-TISSUE THERAPY 1

SECTION I: Foundations 7

CHAPTER 1: COMPONENTS OF STRUCTURE: BONES AND LANDMARKS 8

Overview	9
Skeleton	10
Surface Features	11
Skull	13
Vertebral Column	15
Rib Cage	18
Shoulder Girdle and Humerus	20
Forearm	22
Wrist	22
Pelvic Girdle and Femur	24
Leg, Ankle, and Foot	26
The Leg	26
The Ankle and Foot	27
Connectors of the Skeleton	28
Brief Summary	30
Review Questions	30

CHAPTER 2: STRUCTURAL ANALYSIS AND POSTURAL ASSESSMENT 32

Overview	33
Structural Analysis	34
Postural Assessment	34
Anatomy of Bone and Muscle Relationship	35
Postural and Functional Kinesiology	37
Postural Kinesiology	37
Muscle and Skeletal Compensation	37
Adaptations and Compensations	37
The Impact of Structural Imbalance	39
Client Interaction	40
Client Self-Awareness and Education	40
Client Interview	40
The Postural Assessment	42
Treatment on the Table	48
Non-symmetrical Work	49
Postures and Relative Pulls of Tension	49
Efficient "Good" Posture	50
Downward Collapsed, "Stooped" Posture	50

Upward Elevated, “Arched” Posture	51
Functional C- and S-Curve Scoliosis	53
Brief Summary	55
Review Questions	55
CHAPTER 3: MUSCLE TENSION AND CAUSES	58
Overview	59
Introduction to Muscle Tension	60
Muscular Action and Actin-Myosin Ratcheting	61
General Tension	62
Tension in Tendons, Ligaments, and Bones	62
Tone versus Tonus	64
Nerves	64
Relaxation: Stopping Tension	66
Warming Up: The Paradox	66
Distinctions in Relaxation	67
Fitness versus Health	67
How Does It Become Chronic?	67
Temporal versus Spatial Summation	68
Temporal Summation	69
Spatial Summation	69
How Does It Become Excessive?	69
Neuromuscular Discoordination	70
Repetitive Action	70
Davis’s Law	73
Muscle Loading	74
All-or-None Theory of Muscular Contraction	74
Basic Neuromuscular Reflexes	74
Stretch Reflex	75
Withdrawal Reflex	75
Physical or Mental Invasiveness	76
Conditioned Reflexes	76
Subtle Reflexes	77
Resting Tonus and Reciprocal Inhibition	77
Distorted Posture and Movement	77
Stressors and Stress	78
Physical Stress	78
Psychoemotional Stress	78
Trauma	79
Brief Summary	79
Review Questions	79

CHAPTER 4: SYMPTOMS AND CONDITIONS OF MUSCLE TENSION **81**

Overview	82
Muscle Tension Symptoms and Conditions	83
Joint Compression	83
General Dehydration	84
Joint Dehydration	84
Dehydration, Muscle Power, and Muscle Mass	84
Pseudo-Arthritis and Joint Pain	85
Compression of Spinal Disks	85
Facet Joint Syndrome	86
Compression or Irritation of Nerves	86
Sciatica Nerve Irritation	86
Vagus Nerve Irritation	87
Compression of Blood Vessels	87
Irritation of the Periosteum	87
Pressure on Other Muscles	87
Tendonitis	88
Repetitive Strain and Overuse Injury	88
Scoliosis	89
Forward Head-Neck Posture	90
Kyphosis	91
Lordosis	91
Balance and Coordination	92
Gluing and Pseudo-Scar Tissue	93
Fascia versus Muscle	93
Can Fascia Affect Body Posture?	94
Brief Summary	95
Review Questions	95

CHAPTER 5: PRINCIPLES OF REVERSING MUSCLE TENSION **96**

Overview	97
Core Principles of Reversing Muscle Tension	98
Basic Neuromuscular Reactions	98
Slow, Steady Pressure	100
Localized, Radiation, or Referral Pain	101
Mechanisms of Tension Release	101
Volitional Release	101
Reflexive Release	102
The Tonus System	103

Structural Homeostasis	104
Golgi Tendon Organs	104
GTOs and the Tonus System	106
Perpendicular Pressure	108
Constant Relative Pressure	108
Playing the “Edge” in Massage and Bodywork	108
Why No Pain Means More Gain	109
The Arndt-Schultz Principle: Parasympathetic Healing	109
Working with the Edge	111
Recognizing and Working with the Levels of the Edge	111
Maximum Edge	112
Minimum Edge	112
Moderate Edge	112
Client to Therapist Communication	112
Desensitization: Descending Sensory Pathways	113
Reclaiming the Client’s Awareness	113
Restoring the Ability to Feel	114
Layer by Layer and Hidden Neuro-Traps	114
Deep into the Nervous System	115
Time	115
Fascia versus Muscle	115
Implications	115
Warming Up Tissues for Treatment	116
Brief Summary	117
Review Questions	117

SECTION II: Clinical Massage Therapy and Structural Bodywork **119**

CHAPTER 6: POSTERIOR LOWER-EXTREMITY COMPARTMENT (PLEC) **120**

Overview	121
Clinical Success	122
Flexor Digitorum Brevis	123
Abductor Digiti Minimi	124
Abductor Hallucis	124
Gastrocnemius	127
Soleus	128
Plantaris	129
Popliteus	133
Deep Posterior Compartment	135
Flexor Digitorum Longus	135
Flexor Hallucis Longus	136

Tibialis Posterior	137
Hamstring Group	140
Semimembranosus	140
Semitendinosus	140
Biceps Femoris	140
Gluteus Maximus	146
Gluteus Medius	148
Gluteus Minimus	149
Lateral Hip Rotators	153
Piriformis	153
Obturator Externus	153
Quadratus Femoris	154
Gemellus Superior	154
Obturator Internus	155
Gemellus Inferior	155
Stretching	158
Brief Summary	161
Review Questions	161
Critical-Thinking Questions	163

CHAPTER 7: ANTERIOR TORSO COMPARTMENT (ATC) 164

Overview	165
Clinical Success	166
Abdominals	167
Rectus Abdominis	167
External Oblique	167
Internal Oblique	169
Transverse Abdominis	169
Iliopsoas	174
Psoas Major	174
Iliacus	174
Pectoralis Major	181
Pectoralis Minor	181
Subclavius	183
Serratus Anterior	187
Cervical Muscles	190
Sternocleidomastoid	190
Anterior Cervicals—Superficial: Suprahyoids	194
Mylohyoid	194
Digastric	194
Anterior Cervicals—Superficial: Infrahyoids	195

Geniohyoid	195
Stylohyoid	196
Thyrohyoid	196
Sternohyoid	196
Sternothyroid	196
Omohyoid	197
Anterior Cervicals—Deep	197
Longus Colli	197
Longus Capitis	198
Scalenes	203
Scalenus Anterior	203
Scalenus Medius	203
Scalenus Posterior	204
Temporomandibular Joint	206
Masseter	206
Temporalis	208
Medial Pterygoid	209
Lateral Pterygoid	210
Stretching	213
Brief Summary	215
Review Questions	215
Critical-Thinking Questions	217

CHAPTER 8: ANTERIOR LOWER-EXTREMITY COMPARTMENT (ALEC) 218

Overview	219
Clinical Success	219
ALEC	221
Extensor Digitorum Brevis	221
Tibialis Anterior	222
Extensor Hallucis Longus	223
Extensor Digitorum Longus	224
Peroneals	227
Peroneus Longus	227
Peroneus Brevis	228
Peroneus Tertius	229
Quadriceps Femoris	232
Rectus Femoris	232
Vastus Medialis	233
Vastus Intermedius	234
Vastus Lateralis	234
Sartorius	236
Tensor Fasciae Latae	240

Pectineus	242
Adductor Group	245
Adductor Magnus	245
Gracilis	246
Adductor Longus	247
Adductor Brevis	247
Iliopsoas	250
Psoas Major	250
Iliacus	251
Stretching	252
Brief Summary	254
Review Questions	254
Critical-Thinking Questions	256

CHAPTER 9: POSTERIOR TORSO COMPARTMENT (PTC) 257

Overview	258
Clinical Success	259
Erector Spinae	260
Multifidi and Rotatores	263
Multifidi	263
Rotatores	263
Quadratus Lumborum	266
Latissimus Dorsi	269
Teres Major	274
Serratus Posterior Inferior	277
Serratus Posterior Superior	278
Trapezius	281
Rhomboids	285
Rotator Cuff	287
Supraspinatus	287
Infraspinatus	288
Teres Minor	289
Subscapularis	291
Splenius Cervicis	294
Splenius Capitis	295
Levator Scapulae	298
Posterior Suboccipitals	301
Obliquus Capitis Superior	301
Obliquus Capitis Inferior	302
Rectus Capitis Posterior Major	302
Rectus Capitis Posterior Minor	303
Occipitalis	305

Stretching	306
Brief Summary	308
Review Questions	308
Critical-Thinking Questions	310

CHAPTER 10: UPPER-EXTREMITY COMPARTMENT (UEC) 311

Overview	312
Clinical Success	313
Flexors of the Wrist, Hand, and Fingers	314
Flexor Carpi Radialis	314
Flexor Carpi Ulnaris	315
Palmaris Longus	316
Pronator Teres	319
Brachioradialis	320
Supinator	323
Biceps Brachii	326
Brachialis	327
Coracobrachialis	328
Extensors of the Wrist, Hand, and Fingers	331
Extensor Carpi Radialis Longus	331
Extensor Carpi Radialis Brevis	332
Extensor Carpi Ulnaris	333
Triceps Brachii	336
Anconeus	337
Deltoid	339
Stretching	342
Brief Summary	343
Review Questions	343
Critical-Thinking Questions	345
Appendix A: Muscles of the Body	346
Appendix B: Receptor Tonus Principles and Neurophysiologic Laws	361
Appendix C: Agonist, Synergist, and Antagonist	362
Appendix D: Chiropractic and Massage: Symbiotic Health Care (Dr. Kelly Huber)	363
Appendix E: The Mind-Body Connection (Robert J. Rotella, PhD)	367
Appendix F: Proper Stages of Rehabilitation of Injured Soft Tissues	368
References and Resources	369
Credits	371
Glossary	373
Index	379
Muscle Index	385

FOREWORD

About 20 years ago, a young man applied for admission to the Suncoast School of Massage in Tampa, Florida. What distinguished this teenager from his peers was that he knew what he wanted to do and had the desire to reach his goals.

“I know I can help people through touch, and I want to learn as much as I can to do it effectively,” Kyle Wright stated.

His mother, Anita Wright, not only encouraged him—she was also a classmate in the program. Anita’s nursing career obviously inspired her son, and she helped keep his young mind on track.

Kyle was a sponge for knowledge and excelled throughout his course of study. He went on to learn from some of the best of the modern massage therapy renaissance: Paul St. John, Judith Walker, George Koussaleos, Dr. William Bonney, Gus Keathley, Tony Gray, Dr. Robert Perault, Leon Chaitow, and many others. It was no surprise that Kyle quickly built a solid practice and established two flourishing clinical massage therapy centers. As the years passed, he recognized the need for clinically based massage therapy training and eventually opened his own school. The success of the school led to opening several other schools and gaining a strong reputation for educational excellence.

I used to joke with my students at the Suncoast School by saying, “There won’t be a new body model next year with new parts, so study this one and you’ll always have a solid foundation to build on.” Kyle never forgot that, and his book reflects the importance yet simplicity of basic skeletal and muscular function.

This is the textbook any massage school instructor would have wished for 20 years ago. It is clear, concise, and specific to clinical massage therapy. I am pleased to recommend Kyle Wright’s book to any student in a massage therapy training program, any practicing therapist pursuing review and continuing education, or any health professional interested in a no-nonsense approach to effective massage therapy.

Yours in touch,

Dan Ulrich

Founding member, Suncoast School of Massage Therapy
Former chairman, Florida Board of Massage Therapy
Former president, Florida State Massage Therapy Association
Retired 2003

PREFACE

FROM THE AUTHOR

Over the last 25 years I've had the privilege of being part of one of the fastest-growing professions in health care: massage therapy. In 1990 I started my first clinical massage therapy school, which eventually evolved into five schools throughout the Southeast. The well-planned curriculum enabled students to graduate with the skills that would make them employable and able to meet the growing demand for clinically trained massage therapists. In the years since starting that first school, I have had the good fortune and freedom to experiment with new approaches to soft-tissue therapy, and now the innovative techniques my schools have been teaching for nearly 20 years are becoming more widely accepted by mainstream massage educators and practitioners.

Structural Balancing is a compilation that reflects my years of education, practice, and instruction in clinical massage therapy. It is a product of many beliefs, including that students are entitled to superior education and individualized training so that they may uphold the professional standards that they continually pursue. The text expresses my philosophy and interpretations of the neuromuscular and skeletal systems and their relation to the body's structure and function. Rather than attempt to encompass a wide range of massage techniques, the book focuses more on specific aspects that I believe to be particularly relevant, such as *structural balancing*, and less on others.

David Scott Lynn (DSL EdgeWork: Yoga-Bodywork Therapeutics) collaborated with me in the writing, research, and development of this text. David's theory on chronic, excess muscle and nerve tension (CEM&NT) has taught me how to reach deeper levels in the body without producing pain by playing the physical and mental "edges," a concept described at length in this book. I am proud to say that his theories on muscular compensatory adaptation have enabled me to take my bodywork to the next level.

I believe that there is a fundamental lack of understanding relative to how postural distortions directly and negatively impact the body. Many people are not aware that poor posture eventually leads to musculoskeletal pathology.

My approach to bodywork includes addressing and eliminating postural distortions caused by muscular tension and muscular imbalances. I believe that musculoskeletal pain is caused by the body's inefficient opposition to gravity. In other words, gravity forces the body's weight

to shift off the bones and onto the muscles. This shifting, altering, and compensating often leads to the formation of trigger points, referral of pain to distant areas, deviations (unevenness) in leg lengths, distortions in the pelvis and spine (misalignments), depressed or elevated shoulder girdles, collapsed (stooped or slouched) upper body, forward head positioning, and other ailments.

My objective is to have students start focusing on muscles that are overly “locked” short from chronic, excess muscle and nerve tension and the muscular imbalances that link poor posture, musculoskeletal pain, and the restriction of body movements.

The premise of this form of bodywork is to create symmetry among muscle groups by consciously applying effective massage therapy techniques and stretches to the *shortened* muscles, not necessarily the painful ones. Practicing this form of nonpainful, deep-tissue work isolates the *cause* of the problem, rather than just massaging the area of complaint.

I strongly encourage the use of repetition while learning the routines in this text. It is also important for students to give continuous feedback during classroom trades. Feedback enables students to have continued academic growth while perfecting hands-on delivery skills. I also encourage students to explore the art and science of clinical massage therapy and structural bodywork on their own, as well as to expand their study and practice of massage therapy in general. Massage therapy is effective by itself or as an adjunct to other interventions, such as flexibility and strength training exercises, chiropractic and acupuncture, and emotional and spiritual healing.

It is with great pleasure that I share my knowledge, experience, and practical skills, which have grown from being in the educational arena and in full-time practice for over two decades. I commend both instructors and students for choosing this course of study and profession, and I sincerely hope that together we may continue to enlighten the world about the value of massage therapy in our health care system today and into the future.

ORGANIZATION AND STRUCTURE

Welcome Chapter: The Value of Soft-Tissue Therapy. The chapter offers a brief introduction to the overall benefits of soft-tissue therapy and describes the phenomenon of CEM&NT, as well as why it should be recognized as a primary cause of many afflictions that are not effectively treated by other therapies, including the more typical massage and bodywork modalities.

Section 1: Foundations (Chapters 1–5)

The following foundational chapters provide a clear understanding of CEM&NT and its associated symptoms, syndromes, and pain. Students will learn to develop effective treatment strategies to meet the specific needs of each client.

Chapter 1: Components of Structure: Bones and Landmarks. Chapter 1 involves a palpatory study of the skeletal body to develop hand-placement skills for learning the muscles and their attachments. Topics include a study of the bones and surface features, bony landmarks, bone positioning as it relates to structure and movement, and where and how muscles attach to bones and the paths they travel over the body’s joints.

Chapter 2: Structural Analysis and Postural Assessment. Chapter 2 discusses visualizing and analyzing the positioning of the client's bones in space and their relationship to each other. Topics include observational skills, the application of structural anatomy and postural kinesiology, muscular imbalances, chronic bad postures, the planes of the body, and how structural analysis and postural assessment allow the practitioner to determine causes of pain and dysfunction that are distant from the apparent symptom.

Chapter 3: Muscle Tension and Causes. Chapter 3 offers an in-depth look at the various causes of muscle tension and provides insights into how it can be prevented and how it should be treated.

Chapter 4: Symptoms and Conditions of Muscle Tension. Chapter 4 describes how muscle tension directly and indirectly causes specific conditions and symptoms.

Chapter 5: Principles of Reversing Muscle Tension. Chapter 5 provides clinical approaches to soft tissues and chronic tension, including an explanation of why soft-tissue therapy, when improperly applied, can be ineffective or counterproductive.

Section II: Clinical Massage Therapy and Structural Bodywork (Chapters 6–10)

Clinical massage therapy and structural bodywork (at one level) are two different therapy disciplines. Clinical massage therapy involves the ability to understand and effectively identify and manipulate the soft tissues of the body for the purpose of reducing chronic, excess muscle tensions that contribute to the onset of pain and dysfunction. Structural bodywork adds a level of sophistication in scientifically tracking down the aches, pains, and dysfunctions that are not sufficiently responsive to localized (at the location of symptoms) treatment of neuromuscular and myofascial structures.

Each chapter contains pertinent information structured in an easy-to-follow format to assist in facilitating the student's learning of the muscles, origins, insertions, functions, and myotomes. Pain referral patterns associated with each muscle, clinical notes for discussion and reference, patient positioning, and treatment routines are all included.

Chapter 6: Posterior Lower-Extremity Compartment (PLEC). Chapter 6 covers the muscles of the posterior lower-extremity compartment and the related problems that can manifest in muscles of the foot, calf, posterior and lateral thigh, buttock, and hip.

Chapter 7: Anterior Torso Compartment (ATC). Chapter 7 covers the muscles of the anterior torso compartment and the related problems that can manifest in muscles of the abdomen, chest, anterior neck, and jaw.

Chapter 8: Anterior Lower-Extremity Compartment (ALEC). Chapter 8 covers the muscles of the anterior lower-extremity compartment and the related problems that can manifest in the muscles of the foot, shin, and anterior and medial thigh.

Chapter 9: Posterior Torso Compartment (PTC). Chapter 9 covers the muscles of the posterior torso compartment and the related problems that can manifest in the muscles of the lower, middle, and upper back and of the shoulder and posterior neck.

Chapter 10: Upper-Extremity Compartment (UEC). Chapter 10 covers the muscles of the upper-extremity compartment and the related problems that can manifest in the muscles of the arm, forearm, and hand.

FEATURES OF THE BOOK

Structural Balancing has the following unique features to stimulate the learning process:

- ✦ **Tables** summarize important information at a glance.
- ✦ **Learning Outcomes** at the beginning of each chapter show important points for a quick understanding of the chapter's contents.
- ✦ An **Overview** at the beginning of each chapter provides a glimpse of the chapter's content.
- ✦ **Clinical Success stories** in Chapters 6 to 10 describe real-life situations and the clinical approaches and applications of the work.
- ✦ **Full-color photos and illustrations** of the featured techniques and body structures enhance the learning experience.
- ✦ **OIAM charts** list the muscle origins, insertions, actions, and myotomes for each major muscle.
- ✦ **Clinical Notes boxes** describe the key elements and pertinent information about the muscles being treated.
- ✦ **Routine boxes** demonstrate client positioning and the proper hand placements for delivering effective clinical massage therapy techniques.
- ✦ **Stretching exercises** at the end of Chapters 6 to 10 illustrate safe and effective stretches for improving flexibility.
- ✦ A **Brief Summary** at the end of each chapter lists key points of the chapter to help students retain what they read.
- ✦ **Review Questions** at the end of each chapter reinforce the concepts.
- ✦ **Critical-Thinking Questions** at the end of Chapters 6 to 10 draw on the Clinical Success stories and prompt students to consider what they would do in a similar situation.
- ✦ The **Muscle Index** at the end of the book provides a quick reference for finding a specific muscle.
- ✦ The **hard-bound spiral cover** allows the book to lie flat for easy reference while studying or during practical applications.
- ✦ The **Online Learning Center** provides links to supplemental education materials.

The appendixes contain valuable information about the significance of massage and bodywork, chiropractic adjustments, reducing negative thought processes of the mind-body, and stages of rehabilitation, all of which are connected in the healing process. This material will help enhance the student's awareness and understanding of some relevant disciplines that support the combined overall healing of the mind and body. Additionally, a visual muscle appendix illustrates some of the muscles in different sections of the body to aid in the visual learning process.

The appendixes include:

- ✦ Appendix A: Muscles of the Body
- ✦ Appendix B: Receptor Tonus Principles and Neurophysiologic Laws
- ✦ Appendix C: Agonist, Synergist, and Antagonist
- ✦ Appendix D: Chiropractic and Massage: Symbiotic Health Care (Dr. Kelly Huber)
- ✦ Appendix E: The Mind-Body Connection (Robert J. Rotella, PhD)
- ✦ Appendix F: Proper Stages of Rehabilitation of Injured Soft Tissues

ONLINE LEARNING CENTER (OLC), www.mhhe.com/wright

The OLC consists of the Instructor's Manual, PowerPoint presentations, an image bank of all illustrations, and EZ Test for the instructor. McGraw Hill's EZ Test is a flexible and easy-to-use electronic testing program. The program allows instructors to create tests from book-specific items. It provides a wide range of question types, and instructors can add their own questions as well. Multiple versions of the test can be created, and any test can be exported for use with course-management systems such as WebCT, BlackBoard, or PageOut. EZ Test Online is a new service that gives instructors a place online where they can easily administer EZ Test–created exams and quizzes. The program is available for both PC and Macintosh operating systems.

The OLC also has a student section that consists of PowerPoint presentations, flashcards, and quizzes.

Kyle C. Wright, LMBT, NCTMB

ACKNOWLEDGMENTS

AUTHOR ACKNOWLEDGMENTS

My gratitude for the following individuals cannot be expressed by mere words alone. I am honored to have the opportunity to at least begin to give thanks.

My mother Anita, for her guidance and for being a supportive partner during our class assignments.

Dan and Tekla Ulrich, for their instruction and for owning and operating a great school.

My first teachers, Gus Keathley, Tony Gray, Dr. William Bonney, and Dr. Robert Perault, who instilled a passion in me for the massage therapy profession and opened my eyes to the endless possibilities while directing our “classroom trades.”

Ingo Grammel and Darcy Ladd and to the creative team at Caraway Grammel & Associates, for their initial layout and design of my educational manual used in my schools.

Gloria Swanson, for creating many of the illustrations of the muscles and pain patterns.

Tiffany Manning, for shooting the photographs of the hand placements and stretching photos.

Corie R. Wright, for the modeling of my hand-placement photos and her support in the development of this book.

Michelle Langevin, for modeling the positions for my stretching photos.

David Scott Lynn, for contributing a new, refreshing, and innovative style of writing that is technically in-depth yet forward thinking and inspiring.

Judith Walker Delaney, LMT, for teaching me the “tools of the trade” and for the many seminars I had the privilege of assisting her in.

Dr. Janet Travell, Deane Juhan, Leon Chaitow, Tom Myers, Benny Vaughn, George Kousaleos, Alex Spassoff, David Shue, Aaron Mattes, and Drs. Bruce and Marty Costello, for being pioneers in this field.

All the teachers, assistants and staff of my previously owned Southeastern schools, for supporting my vision and for the years of superior education that each of you provided to the students.

The colleagues of practitioners, namely, Corie Wright, LMBT, Paul Thompson, LMBT, Deborah Austin, LMBT, Sean Ivan, LMT, Patty

Lucas, LMT, Elan Schacter, BS, LMT, for their unconditional support, perseverance, and professionalism while contributing to this book.

Rebecca Razo, for her help in editing the text.

The McGraw-Hill book team:

Editor in Chief: Liz Haefele
Publisher: Kenneth Kasee
Sponsoring Editor: Debbie Fitzgerald
Developmental Editor: Connie Kuhl
Marketing Manager: Mary Haran
Media Developmental Editor: Marc Mattson
Project Manager: Marlena Pechan
Production Supervisor: Janean Utley
Designer: Srdj Savanovic
Digital Production Coordinator: Brent Dela Cruz
Photo Research: John Leland

REVIEWER ACKNOWLEDGMENTS

Lynne Anderson, BA, Social Science/Holistic Health, LMT, NCTMB
High Tech Institute

Jennifer Barrett, BS, LMT
Queensborough Community College

Bernice L. Bicknase
Ivy Tech Community College

Jennifer L. Bierbower, CNMT, LMT, BA
Southeastern Institute

Susan Bova, BS, NCBTMB
Penn Commercial

Nathan Butryn
Boulder College of Massage

KC Chambers, NCTMB/NMT
Rising Spirit Institute of Natural Health

Nathan Cuddihy-Garner
Boulder College of Massage Therapy

Barbara J. Harwell
Stark State College of Technology

Amy R. Holibaugh, MA, NCTMB
Community College of Vermont

Karen A. Jackson, NCTMB, LMT, ACMT
St. Louis College of Health Careers

Gerald D. Larson Jr.
National American University

Mary E. Larson, CMT, RMA
Independent

Scott La Salle
MedVance Institute

Gion Lee
Massage Therapy Program Director
Utah Career College

Theresa Lowe, LMT, NCTMB
Hesser College

Bernadette Della Bitta Nicholson
Springfield Technical Community College

Cindy Pavel, MPA, CMT
Davenport University

Jason Prince
Steiner Education Group

David J. Razo
InterCoast Colleges

India Sanders
MMC

Nancy Smeeth
Connecticut Center for Massage Therapy

Michael A. Sullivan, BS, CMT
Anne Arundel Community College

Brad D. Welker, D.C.
Central Oregon Community College

Blayne Wiley
Eagle Gate College

Kim Woodcock, NCBTMB
McCann School of Business & Technology

CONTRIBUTOR ACKNOWLEDGMENT

CONTRIBUTING WRITER: DAVID SCOTT LYNN (DSL EDGEWORK) David is the primary author of Chapters 3, 4 and 5 of this work.

David Scott Lynn has been involved in alternative approaches to living and body-mind therapies for most of his life, beginning with martial arts and Zen-style meditation at age 14.

David's primary yoga teacher was Joel Kramer, an influential developer of several physical, mental, and relational yoga principles, whom *Yoga Journal* acknowledges as the "Father of American Yoga." In 1976, following his studies with Kramer, David began teaching his own style of yoga therapeutics with a strong emphasis on Kramer's principles. As a yoga instructor, David met many other influential people, including Eugene Donaldson, cofounder of Educating Hands in Miami, Florida, who would ultimately help shape his early studies of bodywork.

In 1981, David became a professional massage and bodywork therapist and went on to learn from Daniel Blake—a student of Ida P. Rolf. Blake left the Rolf Institute to develop his own system of structural bodywork, of which David was an early student. David's own structural balancing system is based on a basic formula he learned from Blake.

With a solid foundation in and extensive practice of physical/mental yoga and structural bodywork, David began to apply and integrate yogic understandings, as well as many principles of natural medicine and holistic health, into hands-on bodywork and yoga therapeutics. Decades of studying musculoskeletal anatomy, neuromuscular and myofascial physiology, and the physical sciences, and working with a number of medical doctors, osteopaths, and chiropractors, eventually led David to develop his own unique and highly effective system of yoga/bodywork/whole-health therapeutics, much of which involves working with the edge: physical, mental, and relational limits characterized by pain, fear, and other forms of resistance. This system is known as **DSL EdgeWork**. During his subsequent years of traveling and teaching yoga and bodywork therapeutics at schools around the country, David's work has been adopted by many massage therapy and yoga instructors and practitioners.

David teaches advanced continuing education courses in a number of health care disciplines throughout the country. David has created a section on his website for users of this book at: www.dsl-edgework.com/mh



WALKTHROUGH

A VISUAL GUIDE TO **STRUCTURAL BALANCING: A CLINICAL APPROACH**

CLINICAL MASSAGE THERAPY AND STRUCTURAL BODYWORK 165

LEARNING OUTCOMES

After completing this chapter, you will be able to:

- 7.1 Define the origins and insertions of the muscles of the ATC.
- 7.2 Describe the actions of the ATC.
- 7.3 Recognize the pain patterns of the ATC.
- 7.4 Discuss the clinical notes for and the importance of treating the muscles of the ATC.
- 7.5 Demonstrate the client positioning and treatment routines related to the ATC
- 7.6 Demonstrate safe and effective stretching techniques for the muscles of the ATC.

OVERVIEW

Like the posterior lower extremity compartment (PLEC), the anterior torso compartment (ATC) includes muscles that pull the rib cage down, flatten the lumbar spine, compress the lumbar and cervical disks, and entail many muscular imbalances that cause stooped posture and pain.

Shortened abdominal muscles will pull the rib cage down and cause a forward neck and head positioning (FHP). Often, this downward collapsed, “stooped” posture will reverse the cervical curvature of the spine and compress the lower cervical disks and suboccipital joints, subsequently decreasing cervical range of motion and many back, shoulder, and upper-extremity pain syndromes. The extensors of the lumbar and cervical spine and the retractor muscles of the scapulae often are tighter, produce the most trigger points, and elicit the most pain. It is these posterior compartment muscles that countertighten and resist the forward and downward pulls of tension from the shortened trunk flexors and hip extensors. (An analogy: A tree is held up with guide wires and the tree bends to one side from sustained winds—it is the lengthened wires that become tighter as they resist the weight of the tree being pulled over by the wind.) The abdominals, psoas, serratus anterior, pectorals, and anterior cervicals are a kinetic chain that, when short, often causes chronic pain of the low back, neck, and shoulders. Often, chronic back, neck, and shoulder pain associated with muscular imbalances that effect stooped posture can be reduced and even eliminated with treatment to the short muscles in the anterior torso, rather than the painful ones often experienced in the posterior torso. Lengthening the abdominals will create space

Every chapter opens with Learning Outcomes and an Overview that prepares students for the learning experience.

Clinical Success stories in Chapters 6 to 10 provide students with real-life practices and events.

Jennifer Bierbower, Southeastern Institute: “The specific client success stories make the study of this material easier to understand and create a clear understanding of how powerful this work can be.”

CLINICAL SUCCESS

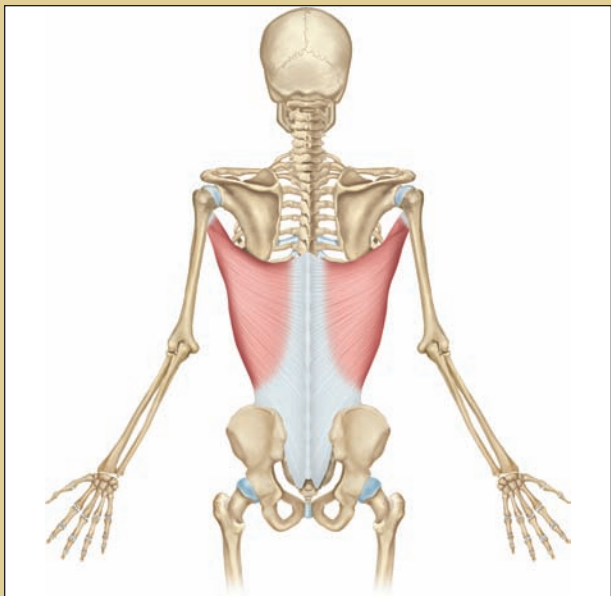
In 2001, a professional golfer on the PGA tour went to a therapist. He complained of a “slight numbness in his fingers with a considerable amount of decreased grip strength of his hands.” Over the course of 3 years, this client had seen numerous health care specialists and been told that he probably had a “neck stinger.” The therapist believed that the man’s complaint was the result of cervical disk compression, irritating the nerve roots at the C4 through C7 levels, as well as entrapment of the nerve supply exiting the soft tissues of his anterior and lateral neck.

During a soft-look evaluation of the client’s body, the therapist observed his projected forward head posture and suboccipital compression at the base of the occiput. He was a right-handed golfer and displayed a dropped right shoulder girdle and a locked short abdominal wall. He also had a significant number of muscular imbalances throughout his body. His primary complaints related to tingling, numbness, and weak grip strength; however, to achieve lasting results, it was necessary to address the imbalances that affected his overall posture.

The client was placed in the supine position on the table and a hard-look evaluation of his body was conducted. After thoroughly examining for lower-body deviations, the therapist concluded that the client’s leg lengths and pelvic bones were symmetrical and that his primary complaint of bilateral upper-extremity numbness and weakness was most likely isolated in the neck and the thoracic outlet. The client was moved into a side-lying position aided by a cushioned body support system. The treatment plan consisted of releasing the anterior cervical muscles, primarily the longus colli, the longus capitis, and the scalene muscles. Releasing these muscles would help restore much of his cervical lordosis, thereby reducing the compression effect on his spinal nerves and at the base of the occiput.

The muscles attached on the anterior tubercles were isolated, and the therapist proceeded to apply slow, deep compression to the scalene muscles; this triggered referrals down the client’s arm and hand. The therapist treated the client bilaterally with a 2:1 ratio, spending more time on the left elevated side; the client’s posterior suboccipital muscles were released. This corrected the positioning of his tilted head and increased his cervical range of motion. A total of 6 hours in 3 days was spent restoring symmetry to his thoracic and cervical muscles.

Slow, focused, and isolated work in the appropriate areas produced remarkable results. These results were leveled shoulder girdles, lengthened abdominal muscles with increased fluid trunk rotation, a substantial increase in cervical hyperextension and rotation, and full reduction of symptoms in his hands and better overall posture. The client experienced no discomfort during the therapy sessions and no residual discomfort during his tournament play.



Dynamic color illustrations and photographs enhance the learning experience for students.

Nancy Smeeth, Connecticut Center for Massage Therapy: “The boxed format of the Origin, Insertion, Action, and Myotome is clear and easy to access for studying. It is a tried and true method of retaining the material.”

CLINICAL MASSAGE THERAPY AND STRUCTURAL BODYWORK269

5. Using the thumbs, isolate the iliolumbar division of the quadratus lumborum. Treat with slow, deep static compression, moving in 1-inch segments at each contact point along the superior border of the iliac crest. (See Figure 9.18.)

6. Using the thumbs, isolate the iliolumbar ligament, between the medial superior border of the iliac crest and the transverse process of L5. Treat with deep static compression and then friction, moving in 1-inch segments. (See Figure 9.19.)

FIGURE 9.17

FIGURE 9.18

FIGURE 9.19

LATISSIMUS DORSI, FIGURES 9.20 AND 9.21

ORIGIN

By way of an aponeurosis attaching to the iliac crest and sacrum, the lower three to four ribs; the spinous processes of the lumbar and lower six thoracic vertebrae; and the inferior angle of the scapula

INSERTION

Intertubercular (bicipital) groove of the humerus

ACTION

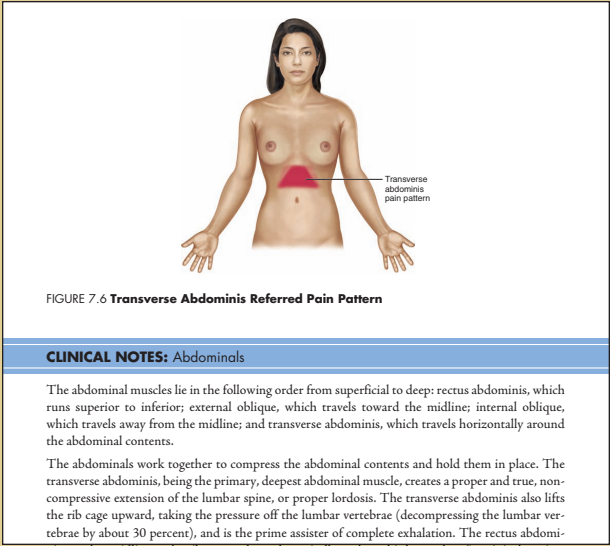
Extends, medially rotates, and adducts the humerus

MYOTOME

Thoracodorsal nerve C6–C8

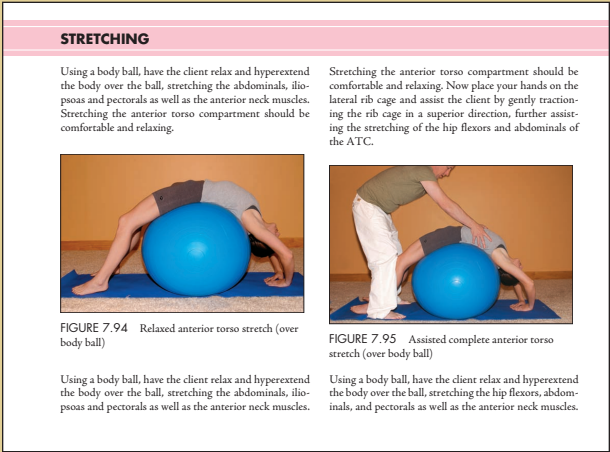
OIAM charts list the individual major muscle information in an easy-to-remember format for students.

Clinical Notes describe the key elements and important information about the major muscles being treated.



Routines demonstrate the proper hand placements required so that students can develop their clinical skills.

Stretching exercises at the end of Chapters 6 to 10 illustrate safe and effective stretches that students can implement to improve their flexibility.



BRIEF SUMMARY

The anterior lower-extremity compartment (ALEC) is a chain of muscles and fasciae that arise from the dorsal surface of the foot and travel upward, attaching to the lower leg, thigh, and pelvis; the ALEC contains the only muscle (the psoas) that directly links the leg to the spine. Muscular imbalances, repetitive injuries, and direct trauma affect many joints of the foot, ankle, knee, hip, pelvis, and spine. Treatment to the ALEC is delivered in sequence, with treatments starting at the foot and ankle and proceeding to the leg and groin.

The Clinical Notes boxes in this chapter cover muscular imbalances that affect posture and pain. The Routine boxes and their illustrations provide guidance for proper hand placements for delivering effective therapy techniques. The Stretching box demonstrates specific stretching techniques that are safe, effective, and easy to do.

REVIEW QUESTIONS

1. Pain in the great toe can be a referral from what muscle?

The key points in the Brief Summaries help students retain what was just learned.

2. Restore the natural spinal curves to the degree possible.
3. Restore a proper and noncombative relationship to gravity.
4. Coach and educate the client in body awareness and self-care techniques.

Clients who receive bodywork sessions and consciously stretch (yoga), along with incorporating retraining exercises, are on the right path to achieving wellness by taking responsibility for their own body.

An experienced massage therapist/bodyworker can be a life-changing coach who assists individuals in achieving a healthier body. The psychological and physical benefits are enormous.

REVIEW QUESTIONS

1. Define *anatomical position*, and explain the three planes of anatomical orientation.

2. Explain structural analysis and postural assessment.

3. Explain postural and functional kinesiology.

4. Define *kinetic chain*.

Review Questions at the end of every chapter reinforce the concepts learned in the chapter.

9. What muscle is the most powerful hip extensor?

10. What muscle refers a pseudo-sciatic pain down the leg?

CRITICAL-THINKING QUESTIONS

A client complains of an acute onset of heel pain in the morning on walking. The client also complains of unusual tightness and cramping of the left calf muscles.

1. What primary muscle could elicit a direct pain referral to the heel?

2. Lengthening which large muscle group would assist the calf muscles in reducing stress to the plantar fascia?

Critical-Thinking Questions in Chapters 6 to 10 draw on the Clinical Success story so that students can reflect on a plan of action.

Muscle Index	
Page numbers in bold indicate major discussion and figures Page numbers in italics indicate routines.	
Abductor digiti minimi	124, 126–127
Abductor hallucis	124, 126–127
Adductor brevis	246–247, 249–250
Adductor longus	246–247, 249–250
Adductor magnus	147, 176, 179, 245–246, 249–250
Acutatus	324, 336–337, 338
Biceps brachii	292, 312–313, 324, 326, 329–331
Biceps femoris	140–141, 144–145
Brachialis	312–313, 324, 327, 329–331
Brachioradialis	313, 320–321, 322–323, 324
Coracobrachialis	328, 329–331, 339
Deltoid	323, 339–340, 340–341
Digastric	194, 200–202
Erector spinae	52, 86, 90, 91, 147, 240, 262, 267, 271, 282
Extensor carpi radialis brevis	322, 332, 334–335
Extensor carpi radialis longus	322, 331, 334–335
Extensor carpi ulnaris	322, 333–334, 334–335
Extensor digitorum brevis	221, 226–227
Extensor digitorum longus	224, 226–227
Extensor hallucis longus	223, 226–227
External oblique	77, 85, 90, 167–168, 172–173, 176, 188
Flexor carpi radialis	314, 317–318
Flexor carpi ulnaris	315, 317–318
Flexor digitorum brevis	123, 126–127, 131
Flexor digitorum longus	135, 138–139
Flexor hallucis longus	136, 138–139
Gastrocnemius	4, 122, 125, 127–128, 131–133, 136, 230
Gemelli inferior	159, 159–167
Gemelli superior	154, 156–157
Glenohumeral	196, 200–202
Glenoid	148–149, 151–152, 155, 176, 241
Glenoid maximus	174, 176, 186, 187–188, 191, 178, 179, 232, 241
Glenoid minimus	77, 86, 149–150, 151–152, 155, 176, 241
Groin	237, 246, 249–250
Iliacus	174–175, 180–181, 251
Infraspinatus	36, 208, 209–211
Internal oblique	77, 85, 90, 168–169, 172–173, 176
Lateral pterygoid	209–210, 211–213
Latissimus dorsi	45, 79, 176, 184, 185, 361, 267, 269–270, 272–273, 275, 282, 286, 357
Levator scapulae	184, 209, 282, 286–289, 299–301
Longus capitis	198–199, 200–202
Longus colli	197–198, 200–202
Masseter	208–209, 211–213
Medial pterygoid	209, 211–213
Mohrland	147, 243–244, 244–245
Mylohyoid	194, 200–202
Oblique capitis inferior	301, 304
Oblique capitis superior	301, 304
Obturator externus	45, 159, 156–157, 267
Obturator internus	45, 159, 156–157, 267
Occipital	305, 306
Oculomotor	195, 197, 200–202
Palmaris longus	316, 317–318
Pectineus	237, 241, 242–243, 244
Pectoralis major	165, 171, 181–182, 185–187, 271, 275, 329
Pectoralis minor	165, 171, 181, 185, 185–187, 329
Piriformis	238, 239–241
Piriformis longus	227–228, 230–231
Piriformis tertius	229, 230–231
Pituitary	151, 153, 156–157
Plantaris	129–130, 131–133, 134
Popliteus	122, 133–134, 134
Protractor teres	319, 320, 324
Protractor teres	77, 85, 165, 174–175, 180–181, 251, 267
Protractor teres	174–175, 251
Quadratus femoris	26, 154, 156–157, 219
Quadratus lumborum	36, 45, 46, 47, 90, 147, 178, 239, 261, 266, 268–269, 271
Quadratus plantae	129
Racina abducta	77, 85, 90, 167–168, 172–173, 176
Racina capitis posterior major	301–302, 304
Racina capitis posterior minor	301, 303, 304
Racina femoris	332, 336–339, 241
Rhomboid	188, 209, 263–264, 262, 285, 286–287
Rotator	147, 176, 263–264, 264–265
Sartorius	236, 238–239, 241, 248
Scalenus anterior	203–204, 205–206, 312, 317
Scalenus medius	203–204, 205–206, 312, 317
Scalenus posterior	203–204, 205–206, 312, 317
Semispinosus	140–141, 144–145
Semispinosus	140–141, 144–145, 337, 248
Serratus anterior	165, 171, 184, 185, 187–188, 189, 282
Serratus posterior inferior	261, 277, 279
Serratus posterior superior	278, 280, 282
Soleus	122, 125, 128–129, 131–133, 138, 230
Splenius capitis	239, 245, 286–288
Splenius cervicis	239, 244, 286–288, 299
Sternocleidomastoid	190–191, 192–193
Sternohyoid	195–196, 200–202
Sternohyoid	195–196, 200–202
Stylohyoid	195–196, 200–202
Subclavius	182–183, 185–187
Subscapularis	185, 271, 275, 309
Supinator	291–292, 293, 312, 317, 337
Suprapiriformis	122, 133–134, 135, 329
Temporals	36, 287–288, 290–291, 339
Tensor fasciae latae	208, 211–213
Teres major	151, 219, 237, 340, 341–342
Teres minor	185, 271, 274, 275–276, 337
Tibialis anterior	288–289, 290–291
Tibialis posterior	195–196, 200–202
Tibialis posterior	222, 226–227
Transverse abdominis	137, 138–139
Transverse abdominis	45, 148–170, 172–173
Trapezius	188, 191, 209, 271, 281, 283–284, 286–289
Triceps brachii	324, 336, 338, 339
Vastus intermedius	233–234, 238–239
Vastus lateralis	233–235, 238–239
Vastus medialis	233, 238–239

The Muscle Index at the end of the book acts as a quick reference guide to the major muscles discussed in the book.

Scott R. LaSalle, MedVance Institute: “The content is strong. It will challenge students and encourage them to be more clinical in their approach to treatment.”

Structural Balancing Information Center: - Windows Internet Explorer provide...

http://novella.mhhe.com/sites/0073373923/information_center_view0, Live Search

File Edit View Favorites Tools Help Convert Select

Novella... Kinesiol... Stru... Home Feeds (1) Print Page Tools

STRUCTURAL BALANCING Kyle Wright

Information Center

Feature Summary
Table of Contents
Book Preface
Sample Chapter
About the Authors

Structural Balancing: A Clinical Approach
Kyle Wright
ISBN: 0073373923
Copyright year: 2011

Online Learning Center
Student Edition
Instructor Edition

STRUCTURAL BALANCING
A CLINICAL APPROACH
Kyle Wright

To obtain an instructor login for this Online Learning Center, ask your [local sales representative](#). If you're an instructor thinking about adopting this textbook, [request a free copy](#) for review.

©2011 McGraw-Hill Higher Education
Any use is subject to the [Terms of Use](#) and [Privacy Notice](#).
McGraw-Hill Higher Education is one of the many fine businesses of [The McGraw-Hill Companies](#).

The Online Learning Center, www.mhhe.com/wright, offers additional learning and teaching tools.

WELCOME CHAPTER
THE VALUE OF SOFT-TISSUE THERAPY

OVERVIEW

Few people, even some health care providers, fully understand and appreciate the benefits of soft-tissue therapy. Some of the key elements of this innovative and unique approach to clinical massage therapy and structural bodywork include:

1. *An in-depth understanding of chronic, excess muscle and nerve tension (CEM&NT):* Many texts discuss “tight” muscles, but few explain what muscle tension actually is, where it comes from, why it is hard to eliminate, and the multiple problems it can cause. However, this knowledge offers therapists a whole new perspective on how to work with CEM&NT, and it offers clients insights into why effective therapy often requires more time than the typical duration of more commonly available treatments.

Classical neuromuscular therapy works quite well. Yet when such commonly available treatments fail or produce only temporary relief, it is necessary to determine the factors that prevent the standard approaches to treatment from working.

2. *Unique insights into structural analysis and postural assessment:* Structural balancing looks at the structural strains and/or neurologically transmitted irritations that develop in many CEM&NT clients. For example, for many people with chronic tension in the neck and shoulders, the true source of tension is the abdominal muscles that pull down on the rib cage and cause the neck and shoulder muscles, through a process of structural homeostasis, to contract in opposition to the abdominals. And, until this imbalance is resolved, every time the client does sit-ups or crunches to “strengthen” the abdominal muscles (the primary contractors), the increased downward pull on the rib cage and consequently the neck and shoulders (the secondary contractors) is made worse and more chronic. Yet, most of the time, the client feels pain in the secondary contractors and does not feel pain in the true, distant origins of tension: the primary contractors. Finding the primary and secondary contractors requires some detective work by the well-trained clinical massage and structural bodywork therapist.

3. *Playing the edge—why no pain means more gain:* Edgework is based on principles of physical, mental, and relational yoga. The *edge* is the amount of pressure or depth applied in a manual technique or stretch; the ideal level applied is that which produces the greatest amount of tension or stress *reduction* in the client, with the least amount of resistance or negative reaction in the client’s psychoneuromuscular system. The edge is different for everyone at different times, and it often changes rapidly and dramatically. Yet working effectively with the edge is much of what determines how quickly, efficiently, and permanently a client’s neuromuscular and myofascial structure will relax. The therapist and the client must maintain a close rapport and open communication (relational yoga) throughout the session so that the therapist can stay attuned to the client’s edges and make the necessary moment-to-moment pressure adjustments. While it is the therapist’s responsibility to watch for clues, it is the client’s responsibility to inform the therapist about whether pressure is too deep, not deep enough, or just right. The edge concept also applies to mental and emotional yoga, which is outside the scope of this text.

Ultimately, being an effective soft-tissue therapy bodyworker requires clarity and honesty about one’s hands-on limitations. Even experienced bodywork therapists continue to be amazed, though

not necessarily surprised, by the effectiveness of manual soft-tissue therapies in treating various conditions of the body and mind.

For certain problems, manual therapies, such as massage, bodywork, and related modalities, are the most effective and least dangerous forms of healing. When hands-on work is warranted—and it often is—other modalities are merely palliative or miss the healing opportunity altogether, often to the detriment of the client. The challenge is for the client's primary physician to determine whether CEM&NT is the client's primary concern.

Unfortunately, massage therapy is often thought of as palliative but not effective for real healing. Many of the more commonly known massage techniques do not involve aggressively therapeutic massage and bodywork. Swedish massage, for example, is excellent for general relaxation and surface circulation, but it cannot create the deeper psychoneuromuscular and myofascial changes necessary to facilitate certain levels of healing, especially when the origin of the problem is structurally related. Swedish massage directly addresses only superficial tissues. While the indirect and deeper effects of Swedish massage are substantial, they are not sufficiently focused on structural change, which is often necessary to create healing. Many clients have tried a wide range of treatments with minimal results. Yet improvement was dramatic once the structural issues, or distant neurologically transmitted irritations, were addressed.

Neuromuscular therapy and similar treatments are excellent for focused work on trigger points or specific tensions; however, they do little for structurally transmitted strains. While these treatments do address some neurologically transmitted irritations, also known as *referrals*, they do not usually treat the more distant, extreme, or elusive irritations.

Effective healing often requires exploring a wide range of modalities and practitioners—because one size does not fit all. It is important to educate potential clients about the vast range of diverse techniques that encompass “bodywork.” Being able to describe the differences between the various approaches is an important part of being a manual therapy practitioner. Although both education and experience are vital to one's ability to produce results, experience—an education in itself—is more critical. Well-educated practitioners, however, gain far more from their experience than do practitioners with little or no education on which to build.

THE NEXUS OF MUSCLE WORK: CHRONIC EXCESS MUSCLE AND NERVE TENSION

Muscles play a central role in many of the afflictions that affect human beings. The **neuromuscular junctions** provide the nexus between the brain and nerves, on the one hand, and the action-generating or symptomatic structures of the body, on the other: the muscles, connective tissues, and organs. In many cases, muscles—the locations that therapists manually contact—are at the intersection between the root causes of the problem and the symptoms. A neuromuscular junction is the end of the motor nerve, called the *motor endplate*, where the nerve **synapses** (attaches) to a small group of muscle cells. According to Guyton's *Textbook of Medical Physiology* (10th edition), the number of muscle cells controlled by each individual motor neuron varies widely from three to several hundred. The number depends on the size and function of each particular muscle, and especially on how much fine motor control is necessary. Saladin's *Anatomy & Physiology* points out, however, that the gastrocnemius, one of the most powerful muscles in the body, has as many as 1,000 muscle cells controlled by one motor nerve. This is because the gastrocnemius does not require the degree of fine control that, for example, the muscles controlling eye movement do. The whole structure—that is, the nerve, the motor endplate, and the specific fibers that the nerve controls—is called the *motor unit*. Synapses are the “switches” that enable (or not) a nerve charge to travel from one neuron to the next. Synapses are like gatekeepers that determine which groups of muscle fibers are going to contract and which are not. Many conditions are the result of muscle and nerve tension in one or more muscles or parts of muscles. Such neuromuscular tensions cause a wide range of other problems, which are summarized in Chapter 3.

The nexus, or focal point, of massage and bodywork, either for relaxation or corrective therapy, is the muscles or, more specifically, the chronic and excess tension developed in the muscles. Muscular tension is an expression of the current and historical state of the client, and everything is recorded. According to many researchers, a vast portion of all the accidents, incidents, stressors, traumas, and even stressful or traumatic thoughts and feelings is stored as **engrams** and produces some percentage of a client's current state of health. According to Taber's *20th Cyclopedic Medical Dictionary*, an engram is “the physiological basis of memory in the central nervous system.” Although the body records positive events too, it is not usually these events that cause problems in the body.

Properly accessing, managing, and relieving chronic and/or excess muscle and nerve tension enables practitioners to relieve the *causes* of muscle tension. These causes are, via the nervous system, a summation of input from other parts of the body, including other muscles and factors that occur deeper within the central nervous system and levels of the brain—all of which contribute to excessively contracted muscles.

TALKING TO THE NERVES VIA THE MUSCLES

Addressing the muscles through properly applied manual pressure—playing the edge—“communicates” to the central nervous system and various levels of the brain and subsequently creates reflexive and volitional responses in the body. These responses lead to the relaxation of the

neuromuscular system, creating many positive changes in the body and mind. At one level, simply reducing stress levels overall can reduce symptoms and produce myriad positive benefits.

SEGMENTAL FACILITATION

The theory of **segmental facilitation** states that irritation to a **somatic** (neuromuscular system) nerve subsequently reflexes into its respective spinal cord level and consequently excites the **visceral** (organ and gland) nerves attached to that level; this often leads to chronic irritation of the related organ systems. A controversial but likely theory suggests that potential communication—and irritation—between spinal cord levels via a vast network of interneurons further complicates these possibilities. Yet the proper application of manual therapies can often reverse this facilitation.

Ultimately, understanding the direct and indirect causes and results of chronic and excess muscle and nerve tension, as well as what to do about it, can help solve a wide range of client complaints. Many soft-tissue problems are hiding where they are not suspected—sometimes far away from the client's perceived symptoms. Training in this more scientific approach will yield a deeper understanding of these structural relationships, and this understanding will serve to further enhance the skills and abilities of the soft-tissue therapist.

SECTION I

FOUNDATIONS

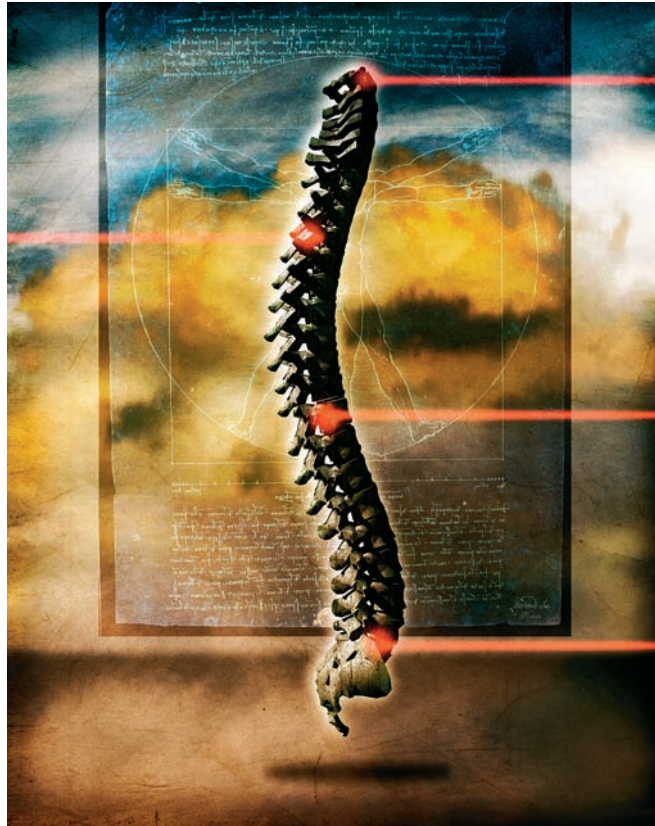
Chapter 1: **COMPONENTS OF STRUCTURE: BONES AND LANDMARKS**

Chapter 2: **STRUCTURAL ANALYSIS AND POSTURAL ASSESSMENT**

Chapter 3: **MUSCLE TENSION AND CAUSES**

Chapter 4: **SYMPTOMS AND CONDITIONS OF MUSCLE TENSION**

Chapter 5: **PRINCIPLES OF REVERSING MUSCLE TENSION**



CHAPTER 1
COMPONENTS OF STRUCTURE:
BONES AND LANDMARKS

LEARNING OUTCOMES

After completing this chapter, you will be able to:

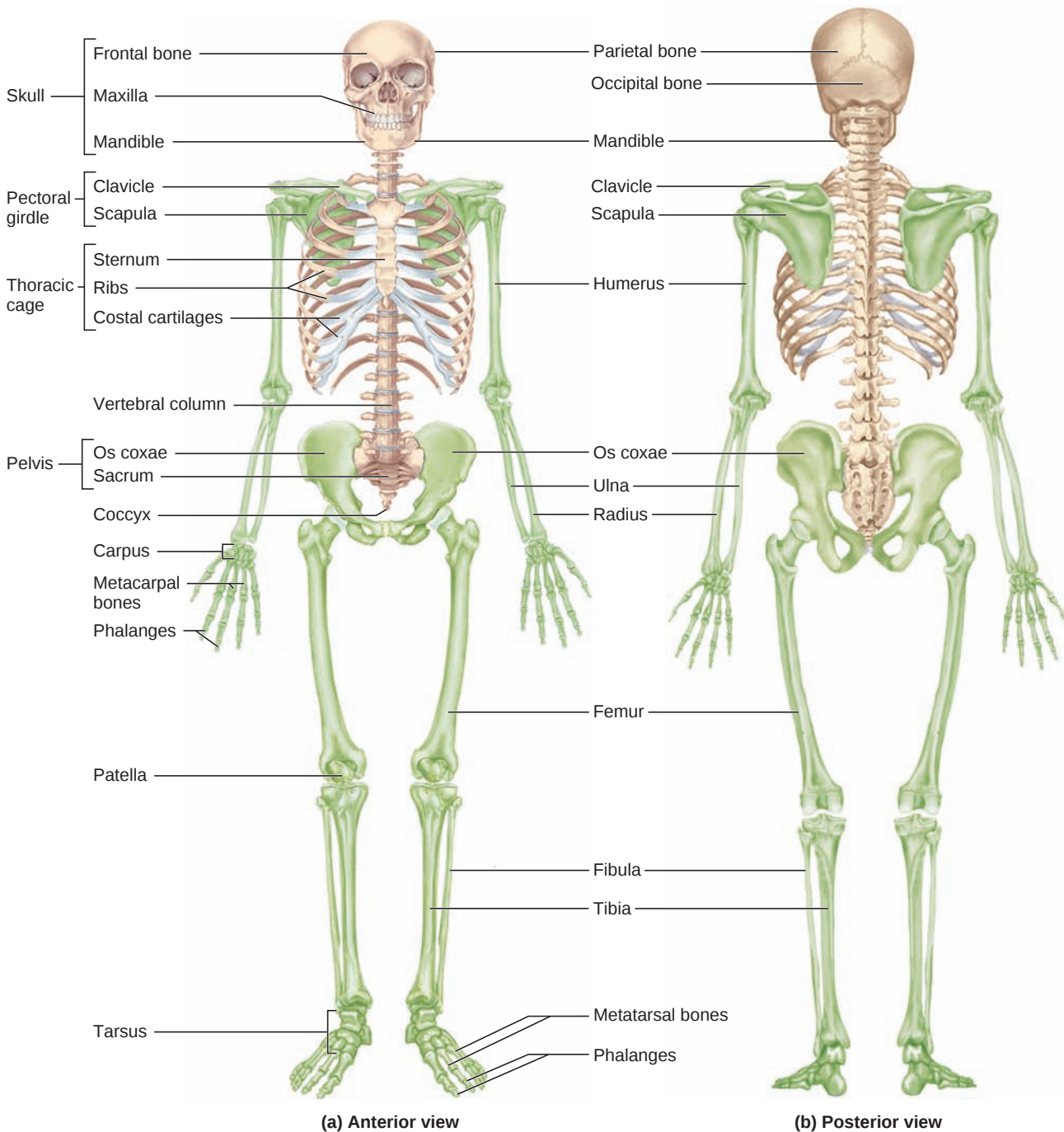
- 1.1 State the approximate number of bones in the adult body.
- 1.2 Name and identify the bones of the skeleton.
- 1.3 Explain the functions of the skeleton.
- 1.4 Differentiate between the bones of the appendicular skeleton and axial skeleton.
- 1.5 Label and identify the surface features (bony landmarks) of the skeleton.

OVERVIEW

In clinical massage therapy education, students typically learn about the skeleton, bones, and surface features first, followed by postural assessment. The skeleton, bones, and surface features help guide students in the proper identification of other bones and their positions as they relate to structure and movement. As students develop palpatory and hand-placement skills, the bones and surface features also assist students in learning the muscles and their attachments. Understanding how the muscles produce movement depends on a student's understanding of skeletal anatomy. It is important to be knowledgeable about the skeleton, bones, and surface landmarks when performing a postural assessment, as they provide visual and palpatory references during a client evaluation.

SKELETON

The skeleton is the structural framework that outlines, supports, and protects the body. It is made up of 206 bones that are adjoined by ligaments, cartilage, and periosteum (Figure 1.1), and it reinforces and distributes the body's weight toward the center of gravity. The skeleton has two divisions: the appendicular and the axial. The *appendicular division* consists of the limb, shoulder,



The appendicular skeleton is colored green; the remainder is the axial skeleton.

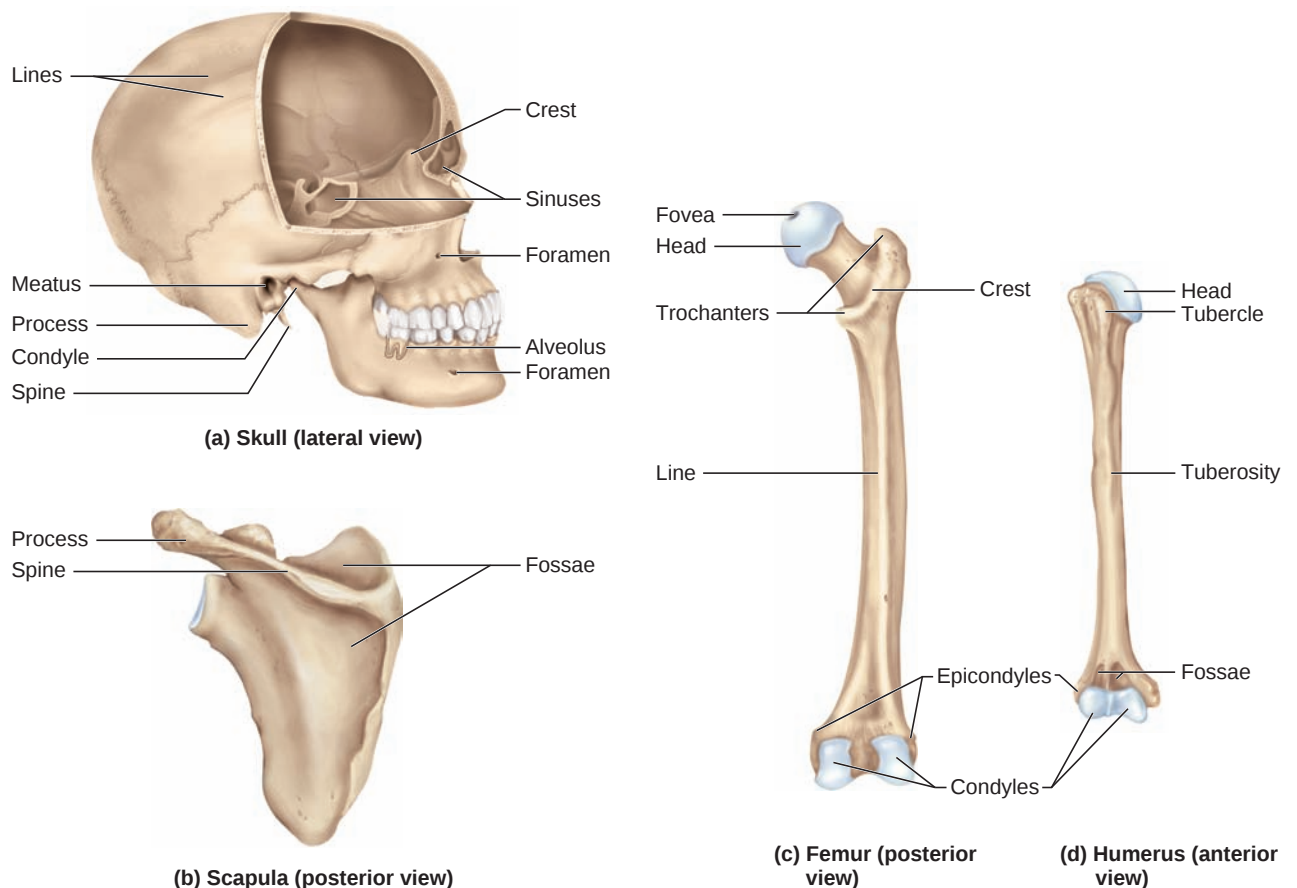
FIGURE 1.1 **The Adult Skeleton**

and pelvic girdle bones. The *axial division* comprises the skull, vertebral column, and rib cage. The shoulder girdle is formed by the scapula and clavicle; it connects the arm to the axial division. The pelvic girdle is formed by the ilium, ischium, and pubis; it connects the leg to the axial division. The skeleton bones are a rigid form of connective tissue primarily made up of calcium phosphate, which provides hardness and strength. The bones support and protect the vital organs such as the brain, spinal cord, heart, and lungs; they also serve as reservoirs for storing and releasing minerals that maintain proper metabolic functioning, growth, and repair. Lastly, the bones provide stability and leverage to the muscular system during movement.

The attachments of the muscles are called the *origin* and *insertion points*. Origins of muscles attach to the least movable bones; insertions of muscles attach to movable bones. Muscle identification is much easier when one understands the skeletal system and can identify the bony landmarks, since bones reveal the body's true position in space as they oppose gravity and move through daily activity.

SURFACE FEATURES

Surface features (landmarks) of bones come in all shapes and sizes. Table 1.1 lists some of these features. Many bony landmarks are projections, indentions, and depressions that are distinctive as they pertain to their corresponding features. (See Figure 1.2.) A thorough study and knowledge of



Most of these features also occur on many other bones of the body.

FIGURE 1.2 **Surface Features of Some Representative Bones**

TABLE 1.1 **Surface Features (Markings) of Bones**

Term	Description and Example
<i>Articulations</i>	
Condyle	A rounded knob that articulates with another bone (occipital condyles of the skull)
Facet	A smooth, flat, slightly concave or convex articular surface (articular facets of the vertebrae)
Head	The prominent expanded end of a bone, sometimes rounded (head of the femur)
<i>Extensions and Projections</i>	
Crest	A narrow ridge (iliac crest of the pelvis)
Epicondyle	A projection superior to a condyle (medial epicondyle of the femur)
Line	A slightly raised, elongated ridge (nuchal lines of the skull)
Process	Any bony prominence (mastoid process of the skull)
Protuberance	A bony outgrowth or protruding part (mental protuberance of the chin)
Spine	A sharp, slender, or narrow process (spine of the scapula)
Trochanter	One of a pair of massive processes unique to the femur
Tubercle	A small, rounded process (greater tubercle of the humerus)
Tuberosity	A rough, elevated surface (tibial tuberosity)
<i>Depressions</i>	
Alveolus	A pit or socket (tooth socket)
Fossa	A shallow, broad, or elongated basin (mandibular fossa)
Fovea	A small pit (fovea capitis of the femur)
Sulcus	A groove for a tendon, nerve, or blood vessel (intertubercular sulcus of the humerus)
<i>Passages</i>	
Canal	A tubular passage or tunnel in a bone (condylar canal of the skull)
Fissure	A slit through a bone (orbital fissures behind the eye)
Foramen	A hole through a bone, usually round (foramen magnum of the skull)
Meatus	An opening into a canal (acoustic meatus of the ear)

the bony landmarks is essential for students entering the massage therapy profession. The ability to locate bony landmarks through touch provides students with a basic template of where and how muscles attach. Students are strongly encouraged to explore their own skeletal body during the learning process; this will help students build proficient palpatory skills.

SKULL

The skull forms the skeleton of the head and face; it is supported by the foundation of the spine and pelvis. The skull consists of irregular-shaped bones and arches that provide protection for the brain, eyes, and inner structures of the ears. (See Figures 1.3 and 1.4.) The skull bones are connected by joints called *sutures* that interlock and are bound by a strong, fibrous connective

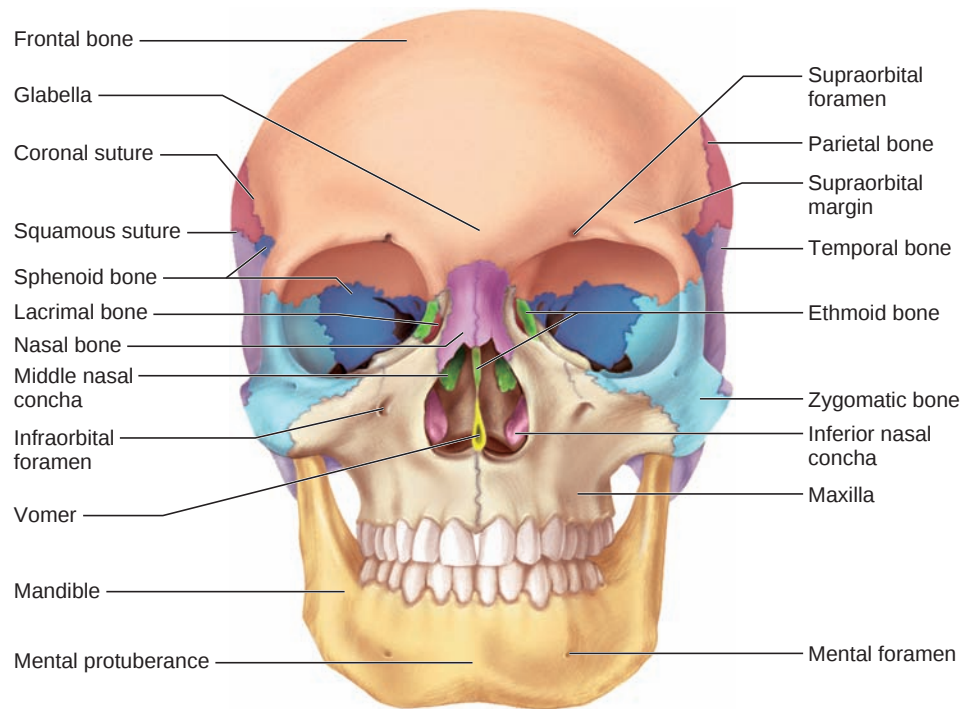


FIGURE 1.3 **Anterior View of the Skull**

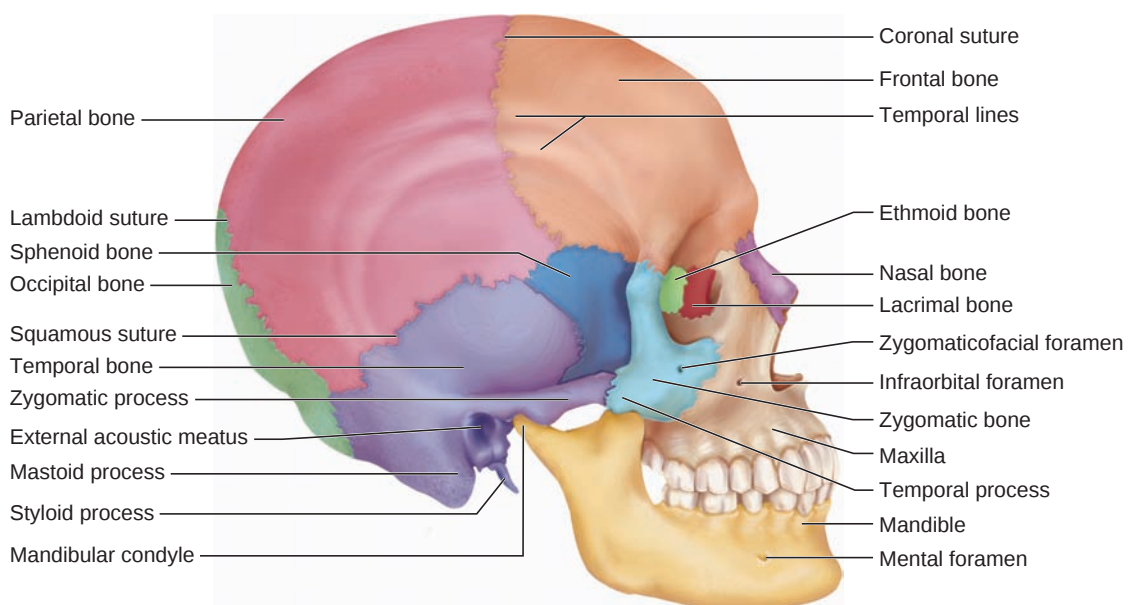


FIGURE 1.4 **Lateral View of the Skull**

fascia. The upper jaw (maxilla) and lower jaw (mandible, Figure 1.5) are joined by ligaments that form the temporomandibular joint (TMJ). The TMJ is the only bilateral joint in the body. The mandible is the movable jawbone that supports the lower teeth and provides attachment for muscles and facial expression. The mandibular condyles are the bony landmarks that articulate with the temporal bones on each side of the temporomandibular joint. The hyoid bone is located below the chin and does not articulate with any other bone. It is suspended by muscles for controlling movements of the mandible, tongue, and larynx. (See Figure 1.6.)

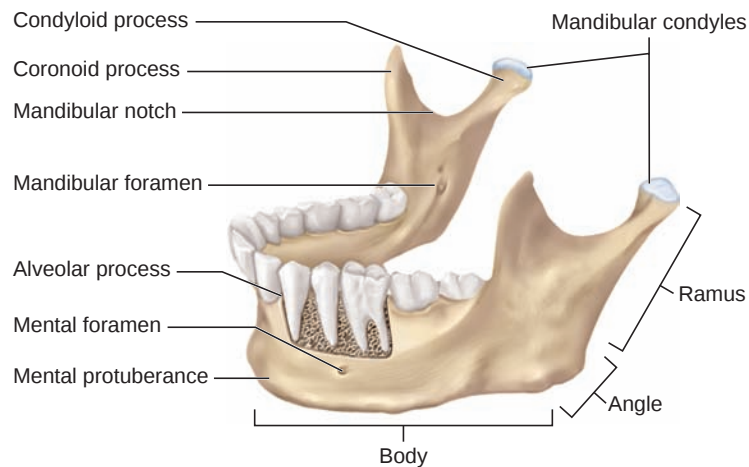


FIGURE 1.5 **The Mandible**

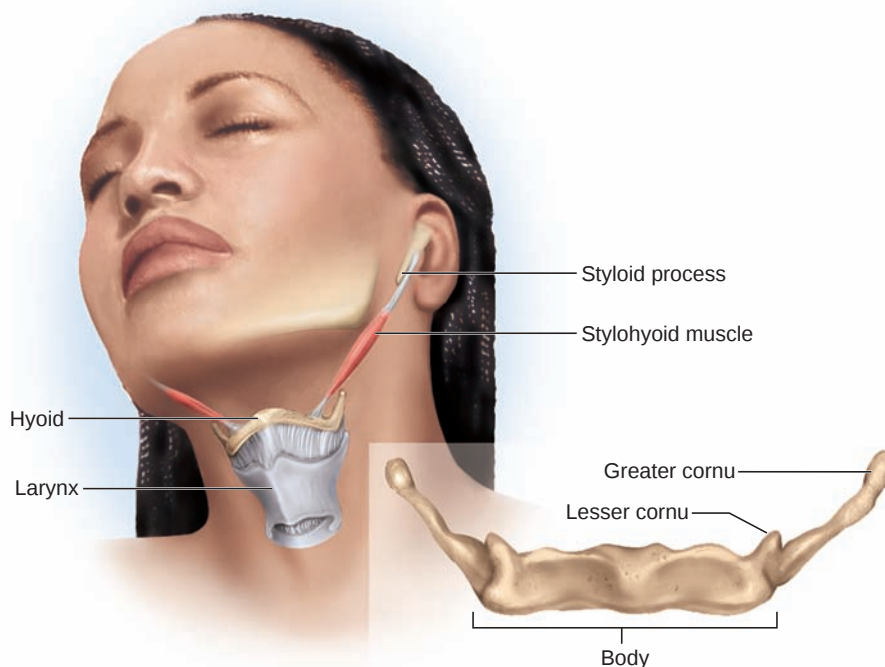


FIGURE 1.6 **The Hyoid Bone**

The facial skeleton forms the eye sockets, bridge of the nose, arches of the cheeks, and contours of the mouth. The bones and landmarks of the head, neck, and face are made up of angles, arches, and processes and are easily palpated for use in muscle identification.

VERTEBRAL COLUMN

The vertebral column (Figure 1.7), or spine, has 33 bones and 5 regions: 7 cervical vertebrae (which form the neck), 12 thoracic vertebrae (which form the upper back), 5 lumbar vertebrae (which form the lower back), 1 sacrum (a bone consisting of 5 fused vertebrae), and 1 coccyx, or “tailbone” (which consists of 4 or fewer semiflexible series of vertebrae). Figure 1.8 shows the sacrum and coccyx bones. In adulthood, the sacral and coccygeal vertebrae fuse to create 26 movable bones, forming the spine. (See Figure 1.9.) The 1st cervical vertebra, C1 (atlas), and the 2nd cervical vertebra, C2 (axis), have unique structures that allow for head movements. (See Figure 1.10.) The head (occiput) articulates with the atlas, forming the first joint of the vertebral column, the atlanto-occipital joint. The atlanto-occipital joint allows rocking and tilting head movements. The axis, C2, projects superiorly a bony landmark called the *dens* (odontoid process). The atlas, C1, sits over and around the dens of C2. This articulation forms the atlantoaxial

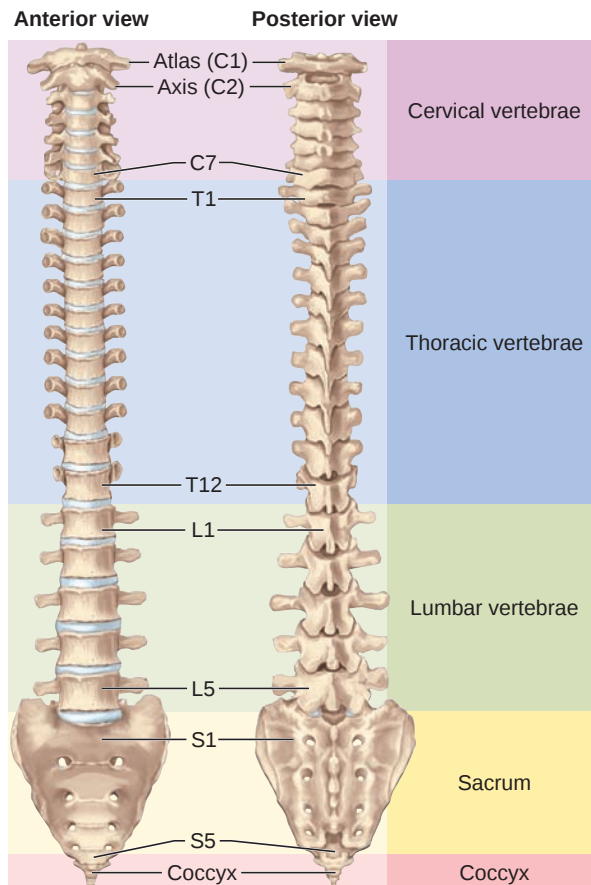


FIGURE 1.7 The Vertebral Column

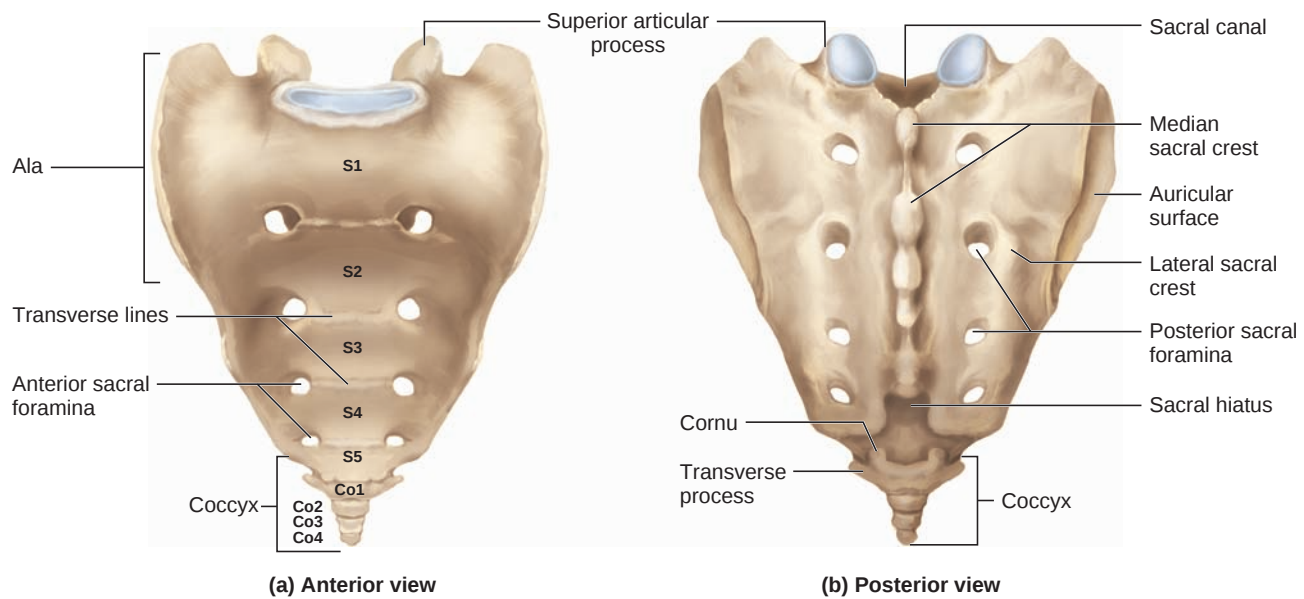


FIGURE 1.8 **The Sacrum and Coccyx Bones**

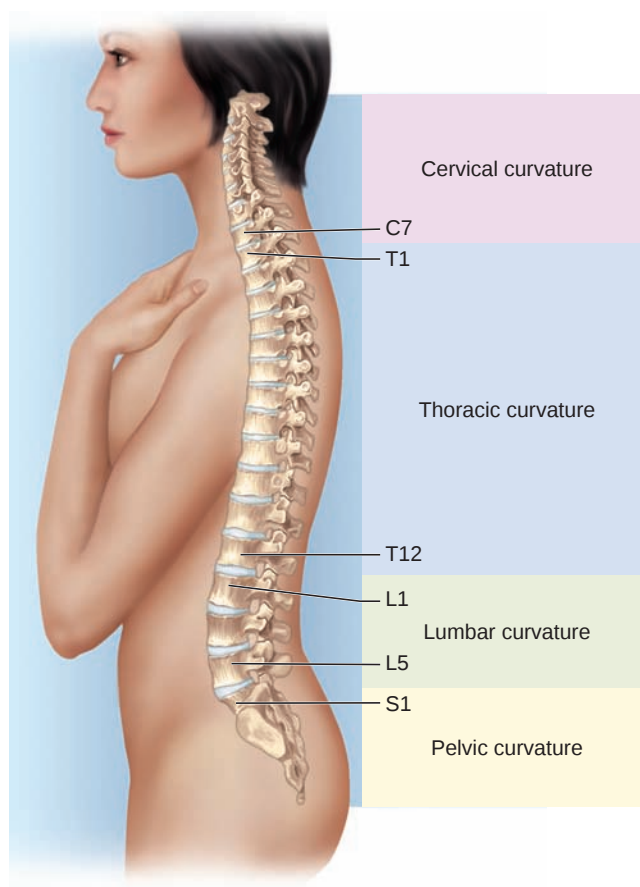


FIGURE 1.9 **Curvatures of the Adult Vertebral Column**

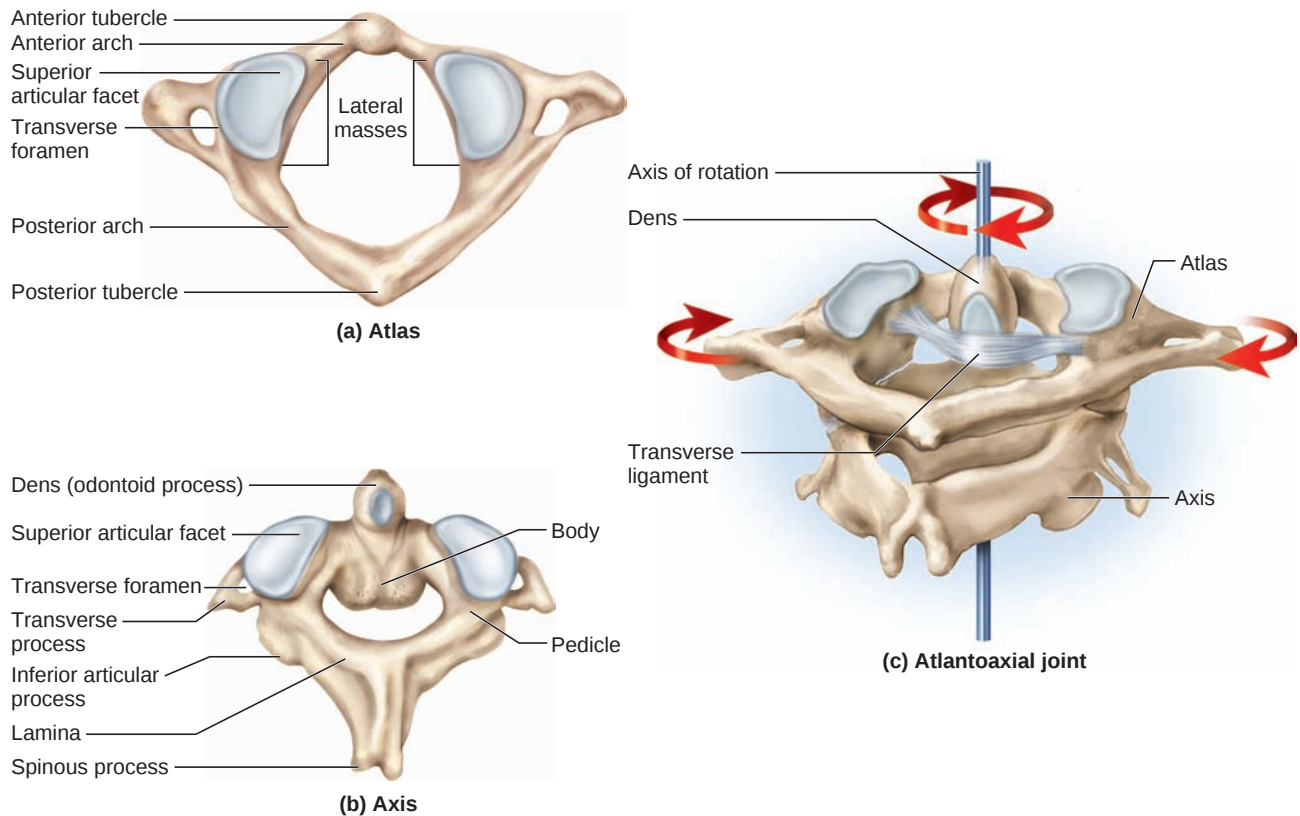


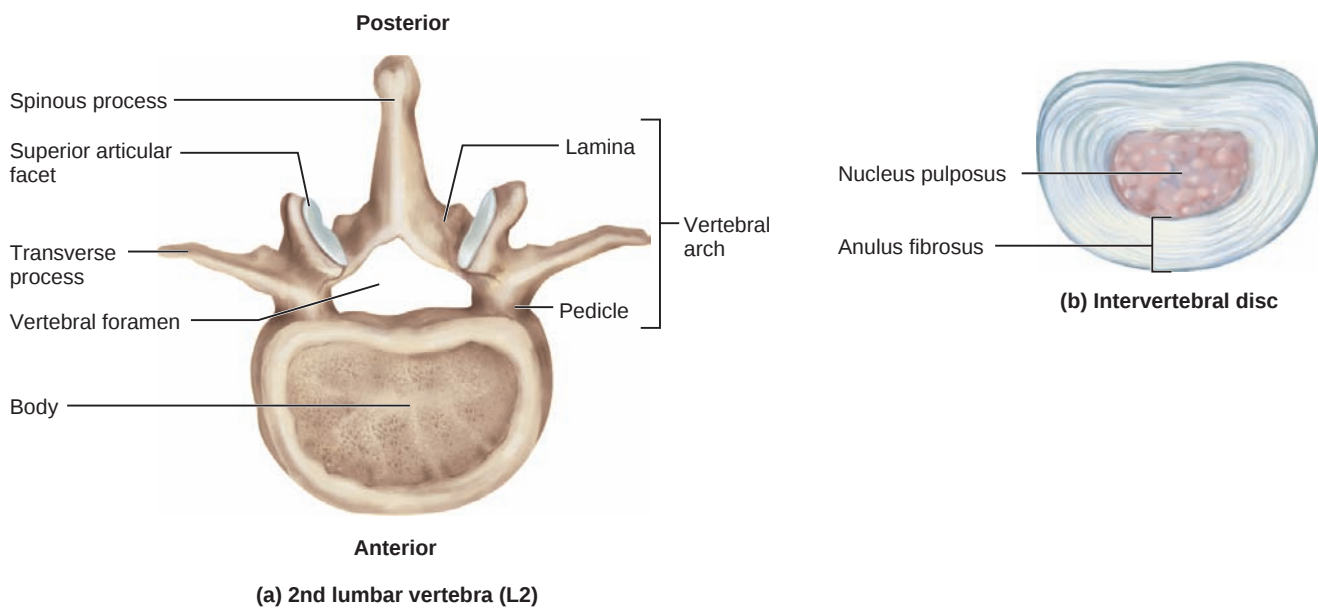
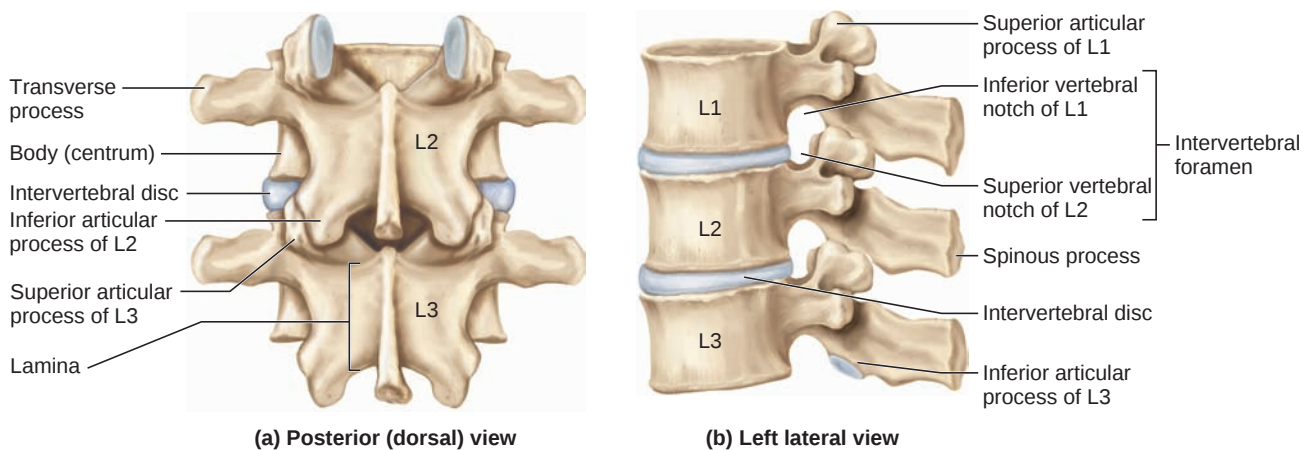
FIGURE 1.10 **Atlas and Axis, Cervical Vertebrae C1 and C2**

joint. This is where approximately 50 percent of cervical rotation occurs; the atlas rotates around the axis.

The vertebral column protects the spinal cord and the emerging nerve roots as they exit the intervertebral foramen.

The vertebral column extends down the center of the back, separating the left and right sides of the body. The spine forms the central axis of the skeleton and supports the weight of the head and trunk. The distribution of weight correlates with the size of the vertebral bodies. The lumbar and sacral regions bear the majority of the upper-body weight, so they are larger to accommodate the weight-bearing loads and movements of the lower back, such as bending and twisting. The intervertebral, or spinal, disks (Figure 1.11) that sit between each vertebral body provide a cushion for the absorption of shock and the transference of body weight to the pelvis and legs. The spinal disks are pads of fibrous cartilage that change shape while under gravitational forces (Figure 1.12), especially if the body is not properly aligned.

Weight-loading exercises, muscular imbalances, and poor posture will increase the likelihood of spinal and sacroiliac joint fixation and disk injury. The spinous and transverse processes of the vertebral column are the points where the majority of spinal muscles attach. While students are learning palpatory skills and hands-on therapy techniques, the processes of the spine serve as reference points for determining muscle location and identification.

FIGURE 1.11 **A Representative Vertebra and Intervertebral Disk (superior views)**FIGURE 1.12 **Articulated Vertebrae**

RIB CAGE

The rib cage provides the shape of the anterior skeleton. (See Figure 1.13.) It protects the heart, lungs, and large blood vessels that are housed within the chest cavity.

The rib cage consists of the sternum, 12 pairs of ribs, and an abundance of costal cartilage. The sternum (breastbone) is formed by three fused bones: the manubrium, sternal body, and xiphoid process. It lies center of midline and forms the anterior chest wall of the rib cage. The manubrium articulates with the clavicles (collarbones) above and the first pair of ribs below. The clavicles and

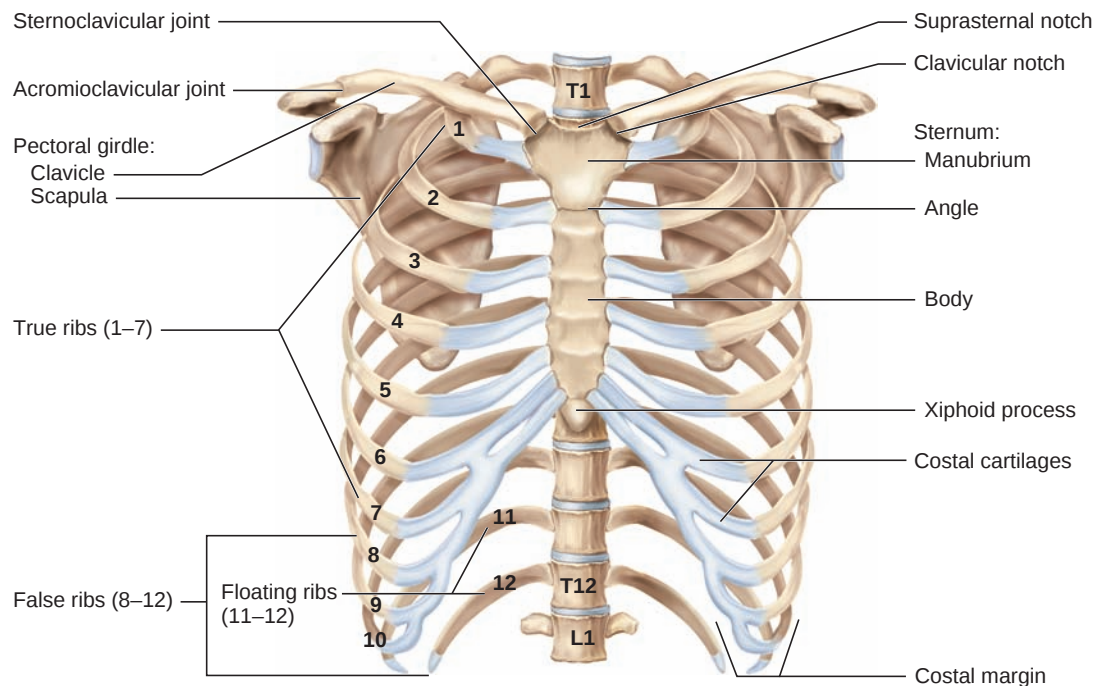
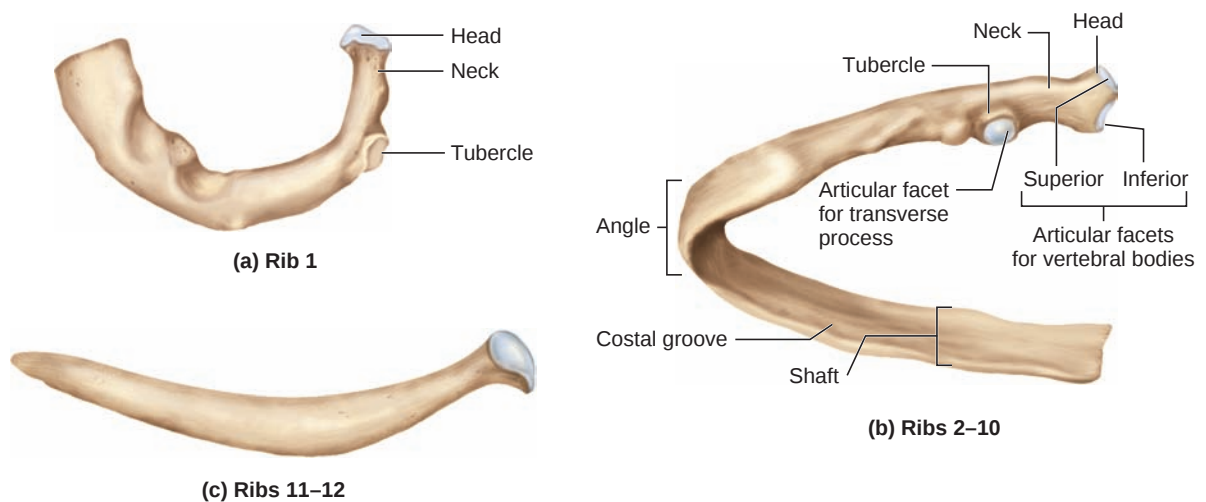


FIGURE 1.13 **The Thoracic Cage and Pectoral Girdle (anterior view)**

sternum articulate to form a pair of sternoclavicular joints medially and acromioclavicular joints laterally, attaching to the scapula (shoulder blade). These two joints that attach at each end of the clavicles are supported by the rib cage and spine, which bind the axial and appendicular divisions together to stabilize the shoulder girdle. The thoracic outlets are located on each side of the upper rib cage between the clavicles and the 1st ribs. The body of the sternum is the central bone and articulates the 2nd through 7th ribs. The upper seven pairs of ribs are called *true ribs* and attach directly to the sternal body by costal cartilage. (See Figure 1.14.) The xiphoid process is the tail end



(a) Rib 1, a typical flat plate; (b) typical features of ribs 2 to 10; (c) appearance of the floating ribs, 11 and 12.

FIGURE 1.14 **Anatomy of the Ribs**

of the sternum. (Note: Use caution when palpating this endangerment site. Avoid deep and direct pressure to prevent trauma and/or fracture.) The 8th through 10th ribs are known as *false ribs*; they descend down from the sternal body via the costal cartilage of the 7th ribs.

The 11th through 12th ribs are known as *floating ribs* and do not attach to the sternal body. They articulate with the transverse processes of the 11th and 12th corresponding thoracic vertebrae of the spine, giving added protection to the internal organs and stability for muscle anchoring. All ribs of the thoracic cage attach to the transverse processes of the segmented structure of the vertebral column; they provide stability for trunk movement.

The costal cartilage is an elastic, flexible, and strong connective tissue. The costal cartilage of the rib cage provides shock absorption from internal and external forces. It provides movement of the rib cage and assists the diaphragm and thoracic costal muscles in controlling the intake and expulsion of air during breathing.

One's success as a massage therapist will depend on how well one learns the bones, landmarks, and muscles of the rib cage and thoracic trunk. Many soft-tissue pain problems and distortions can be managed or even eliminated with treatment to these areas.

SHOULDER GIRDLE AND HUMERUS

The shoulder girdle is made up of two bones on each side of the body: the clavicle (collarbone, Figure 1.15) and the scapula (shoulder blade, Figure 1.16). The clavicle connects medially to the sternum, forming the sternoclavicular joint, and connects distally to the scapula, forming the acromioclavicular joint. The scapula also articulates with the head of the humerus (Figure 1.17), forming the glenohumeral joint. This joint attaches and stabilizes the humerus to the shoulder girdle. The joint surfaces are smooth and covered by a loosely capsulated synovial membrane that secretes a slippery lubricant (synovial fluid) to the cartilage and joints, reducing friction for smooth and unrestricted movements of the humerus at the shoulder joint. The

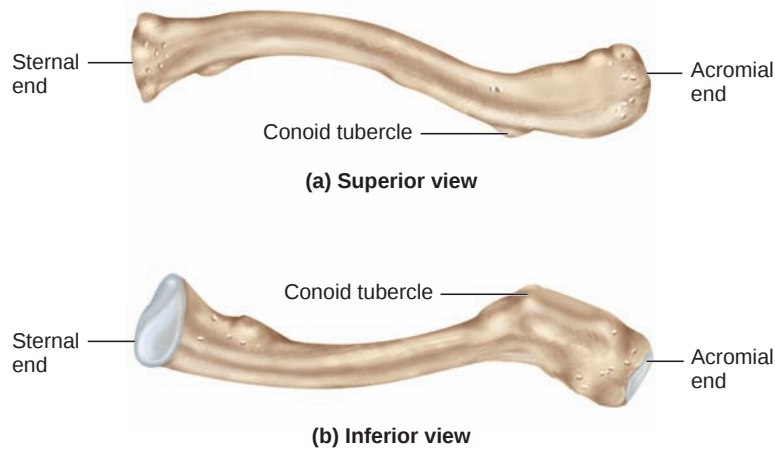


FIGURE 1.15 **The Clavicle (collarbone)**

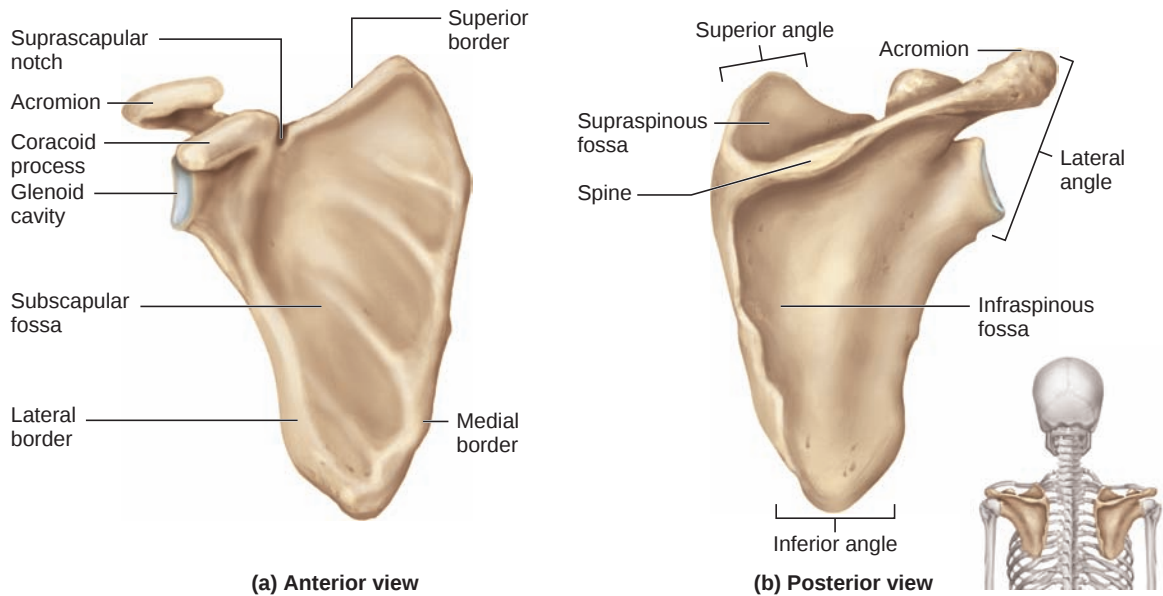


FIGURE 1.16 **The Scapula (shoulder blade)**

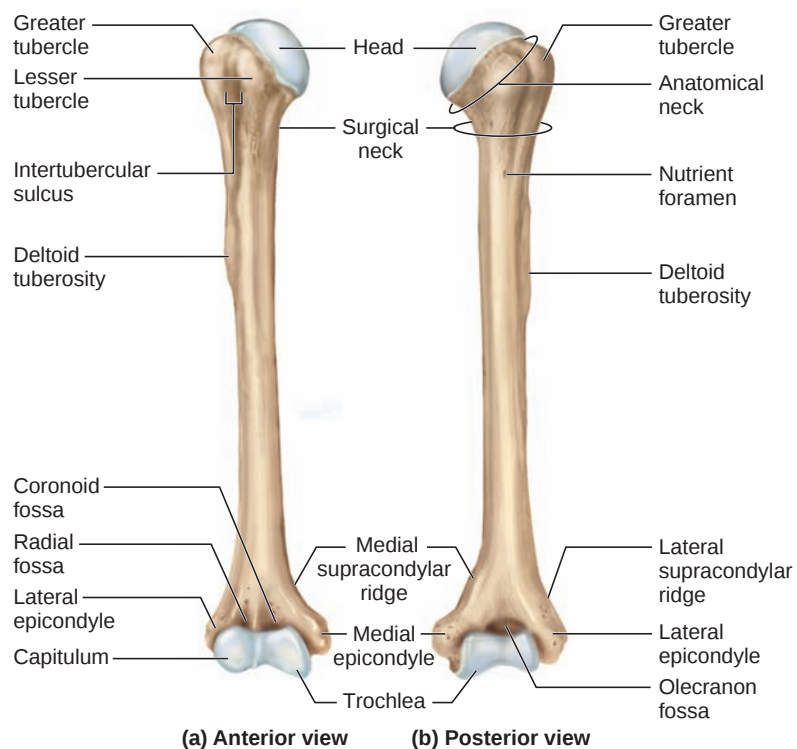


FIGURE 1.17 **The Humerus**

shoulder girdle is structured to hold the arm away from the center of the body's midline. The glenohumeral joint is a ball-and-socket joint that provides full range to the humerus on all planes of motion.

FOREARM

The forearm (Figure 1.18) consists of the ulna and the radius, which articulate with the distal end of the humerus to form the elbow joint. The ulna and radius separate the elbow from the wrist and hands and complete the skeletal framework of the upper extremity. The ulna and radius join medially to form the primary hinge joint of the elbow. At the proximal end of the ulna is a deep, C-shaped trochlear notch that wraps around the trochlea of the humerus. The hinge joint serves as a pulley system that allows flexion (bending) and extension (straightening) movements at the elbow.

The head of the radius is shaped like a round disk that articulates with the capitulum of the humerus, which is shaped like a round ball. The radius and humerus join laterally to form the pivot joint of the elbow, which allows the radius to pivot around the ulna for rotational movements such as pronation (palm down) and supination (palm up). (See Figure 1.19.) Both joints are encompassed in a single synovial joint capsule and secured by ligaments.

WRIST

The wrist is composed of eight carpal bones: the hamate, pisiform, triquetrum, lunate, trapezoid, trapezium, capitate, and scaphoid. These bones attach the forearm to the hand. The multiple joints of the wrist are complex and provide a wide range of movements such as flexion, extension, and ulnar and radial deviations. The wrist is surrounded by dense bands of connective tissue called *retinaculum*, which provides a protective barrier for the synovium, tendons, and nerves that pass through the carpal tunnel. (See Figure 1.20.)

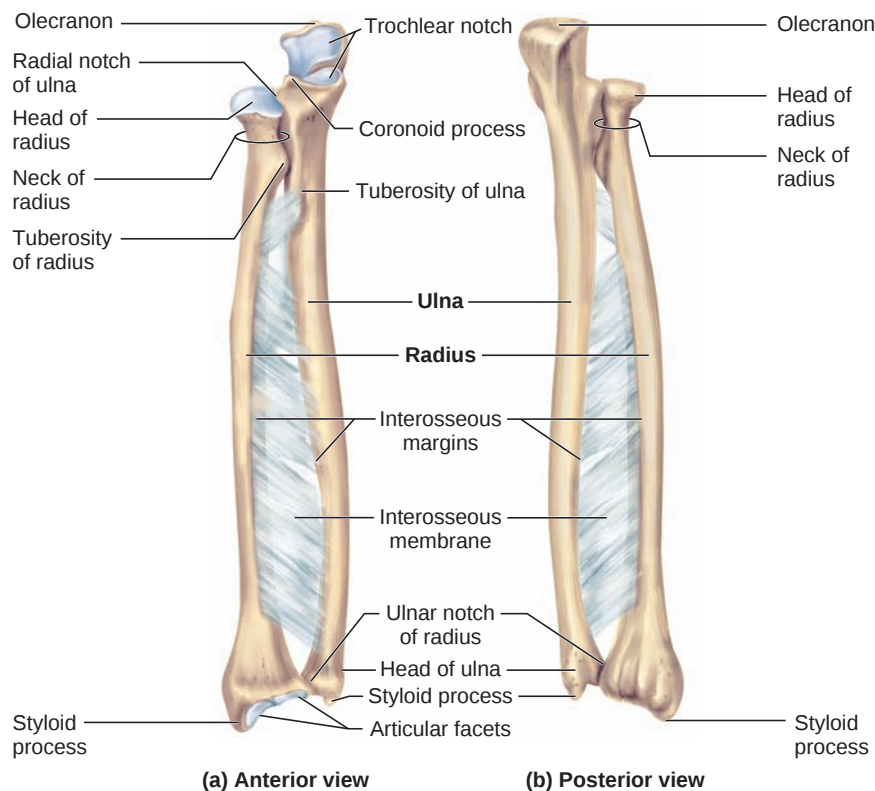
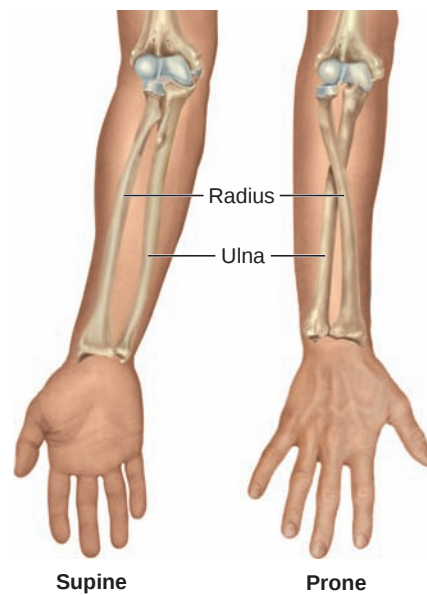


FIGURE 1.18 **The Radius and Ulna**



When the forearm is supine, the palm faces forward. When the forearm is prone, the palm faces rearward. Note the differences in the relationship of the radius to the ulna.

FIGURE 1.19 **Positions of the Forearm**

The hand is composed of five metacarpals that are bones of the palm. The 1st metacarpal is the thumb; the 5th metacarpal is the little finger. On the skeleton, the metacarpals articulate proximally with the carpals of the wrist and distally with the phalanges (finger bones). They seem like extensions of the fingers; therefore, the fingers appear longer than they actually are. Each metacarpal and phalanx has three parts: the base, the body, and the head. The thumb is structured differently, as it does

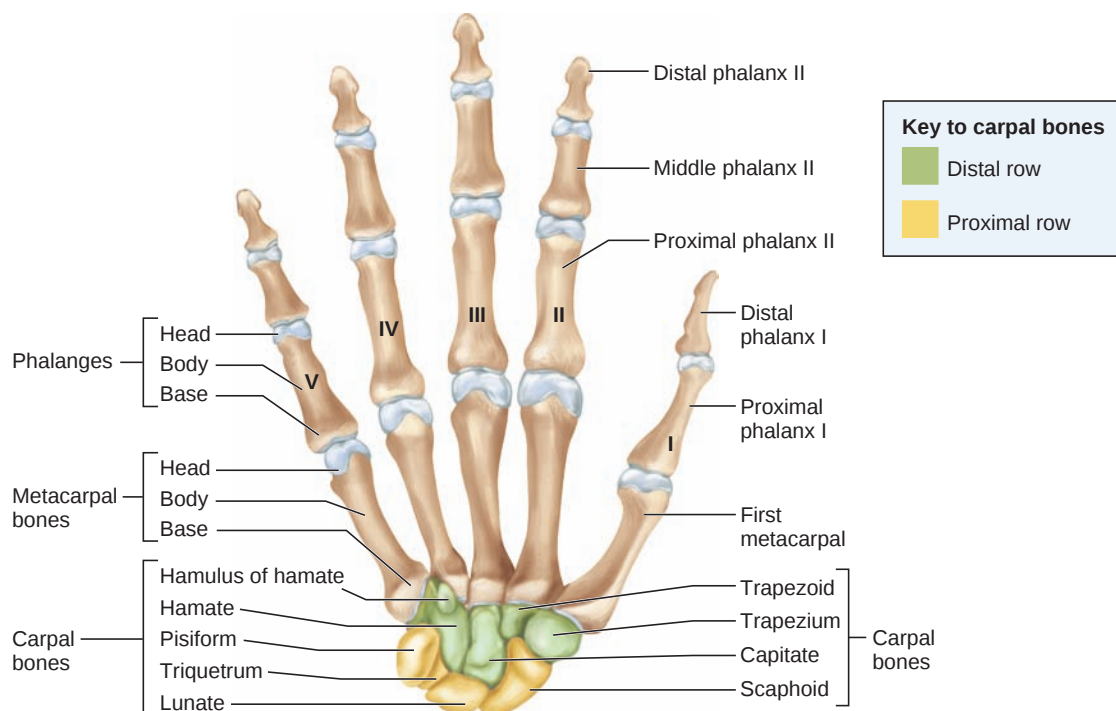


FIGURE 1.20 **The Wrist and Hand Bones**

not have a middle phalanx. The bones of the wrist and hand are articularly specialized; this provides a wide range of motion for grasping objects and performing massage.

PELVIC GIRDLE AND FEMUR

The pelvic girdle (Figure 1.21) forms the central skeletal framework of the body. On the anterior, the pelvis forms the pelvic cavity, which is shaped to protect the internal organs and is supported strictly by ligaments, muscles, and fasciae. On the posterior, the pelvis is the foundation and basin where the base of the vertebral column sits on the superior shelf of the sacrum. The pelvis has two pelvic bones, each having three parts: the ilium, the ischium, and the pubis. The ilium articulates posteriorly and medially with the sacrum to form the sacroiliac joint. The sacroiliac joints, one on each side, absorb much of the weight of the upper body, which descends down through the center of the vertebral column to the pelvis; therefore, strong ligaments are needed to connect and stabilize the vertebral column to the pelvis. These powerful interosseus ligaments facilitate the distribution and transference of body weight from the vertebral column to the pelvis to support a multitude of strenuous trunk and pelvic movements. The iliac crests are located at the level of the waist laterally and create the contours of the superior perimeter of the pelvis. The anterior superior iliac spines (ASIS), anterior inferior iliac spines (AIIS), and posterior superior iliac spines (PSIS) are important bony landmarks for learning muscular identification and postural evaluation techniques of the planes of the body.

The two ischia form the posterior and inferior section of the pelvic bones. Combined, the ischial tuberosities are the bony landmarks on which the body sits and are excellent landmarks for muscle identification. Several large, powerful muscles from all different directions originate on the ischia and ischial tuberosities; they provide many movements of the hip and knee joints.

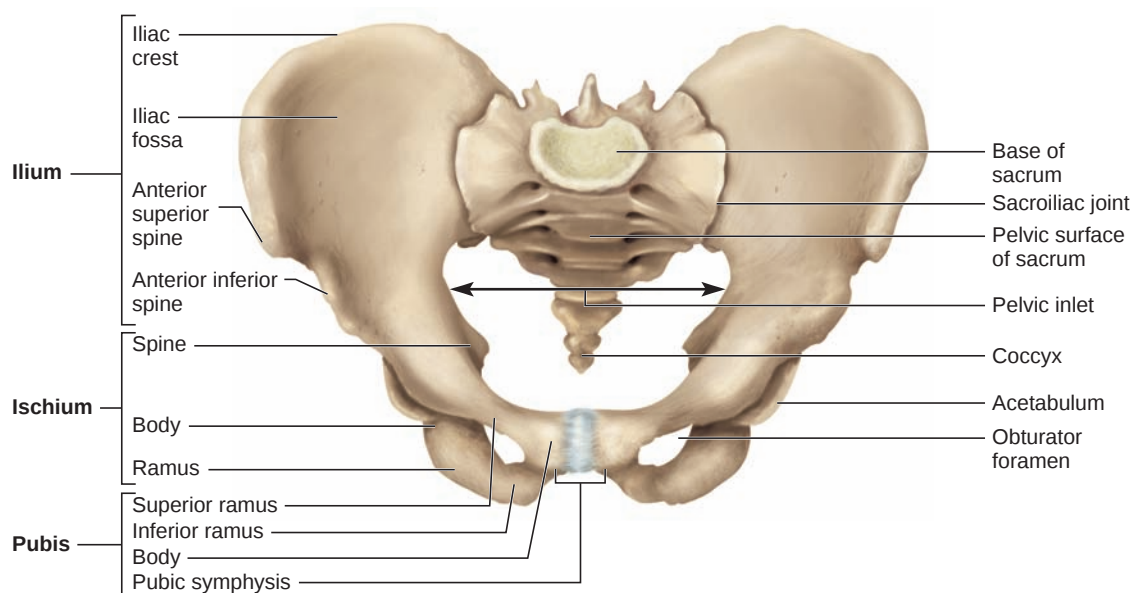


FIGURE 1.21 **The Pelvic Girdle**

The pubis is formed at the midline by each of the pubic bones, which are adjoined by a cartilage known as the *pubis symphysis*. The pubic arches anchor the muscles of the abdominal wall that descend down from the rib cage.

The three parts of the pelvic bone, the ilium, ischium, and pubis, intersect and form the acetabulum (hip sockets). (See Figure 1.22.) The head (ball) of the femur inserts into the acetabulum, forming the ball and socket known as the *hip joint*. The hip joint is held together by an abundance

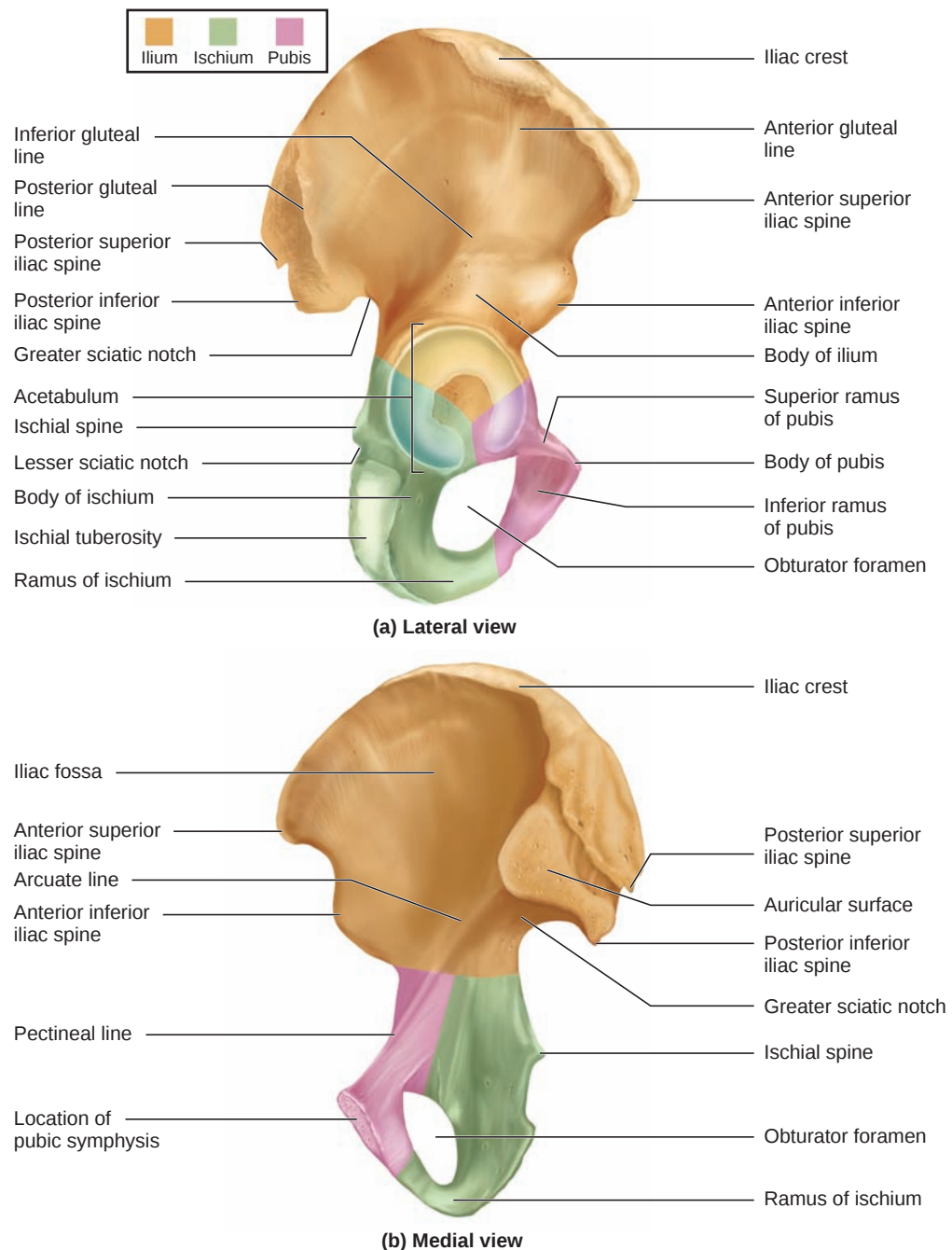


FIGURE 1.22 **The Ilium, Ischium, and Pubis**

of cartilage and ligaments, making it extremely strong and stable for transferring the upper-body weight to the pelvis and legs.

The femur forms the skeletal body of the thigh (upper leg). (See Figure 1.23.) The femur is the strongest and longest bone in the body. It supports the weight of the body and attaches the powerful muscles that provide hip and knee movement.

The femur joins with the pelvic bone above to form the hip joint and with the tibia and patella below to form the knee joint.

LEG, ANKLE, AND FOOT

The skeleton of the leg is made up of the femur (thigh bone), tibia (shinbone), fibula, and patella (kneecap).

THE LEG

The lower leg is composed of the tibia (larger, primary, and weight bearing) and the slender fibula, which joins the tibia at each end. (See Figure 1.24.) The fibula runs parallel and lateral to the primary tibia and serves to stabilize the ankle. The top of the tibia has two flat condyles (medial and lateral) that articulate with the rounded distal end of the femur's two medial and lateral condyles. The patella is embedded in the tendons of the anterior thigh muscles (quadriceps femoris) and

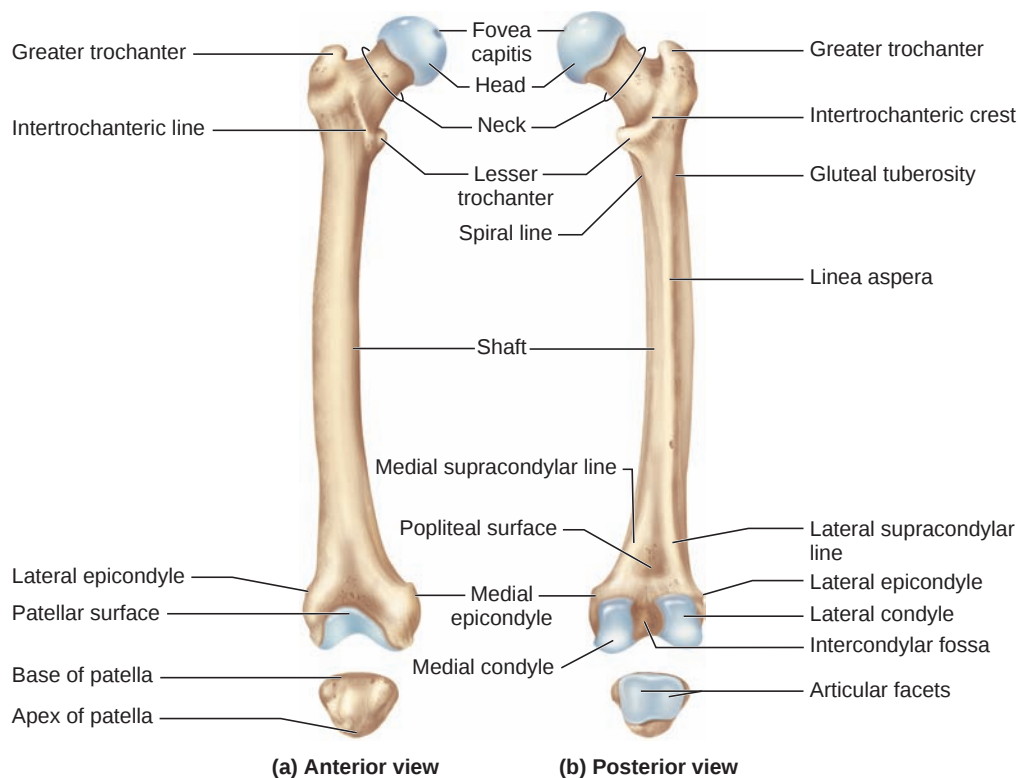


FIGURE 1.23 **The Femur and Patella**

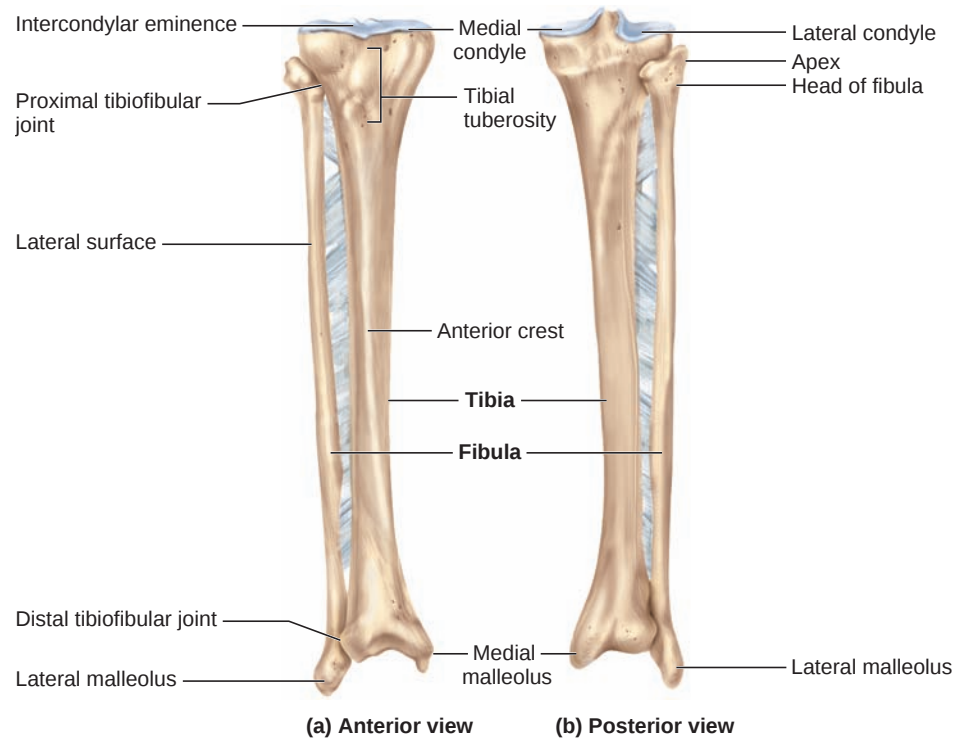
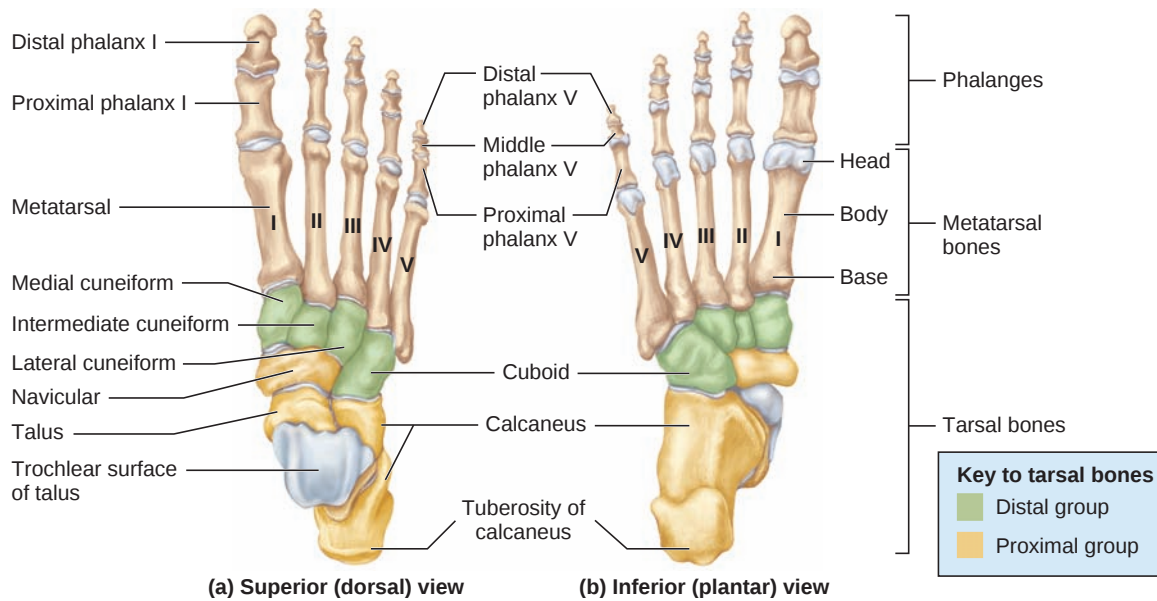


FIGURE 1.24 **The Tibia and Fibula**

forms the patellar ligament that attaches to the tibial tuberosity. The patella overlies the hinge joint formed at the knee and provides flexion, extension, and slight rotation of the lower leg. The knee joint is mobile and weight-bearing; it consists of a synovial capsule for lubricating the joint surfaces, thereby reducing friction during movements. The joint cavity contains two cartilaginous pads (medial and lateral menisci) that cushion the articulating bones' surfaces. The abundance of cartilage surrounding and interlocking the joint capsule absorbs the shock from torsioning (twisting) movements, thereby protecting the joint capsule and reducing the friction damage that can occur between the joint surfaces and ligaments and within the joint capsule.

THE ANKLE AND FOOT

Distally, the tibial and fibular bones of the leg articulate with the tarsal bones of the ankle; they are thoroughly integrated into the structure of the foot. The tarsal bones include the calcaneus, talus, navicular, 1st cuneiform, 2nd cuneiform, 3rd cuneiform, and cuboid, which are similar to the carpals of the wrist; however, because of their load-bearing role, their size and shape are significantly larger. The foot (Figure 1.25) is designed with many complex joints formed by 7 tarsals, 5 metatarsals, and 14 phalanges that support the entire weight of the body when it is standing, walking, and running. Strong ligaments and retinaculi are needed to bind the segmental structure of the ankle and foot together for many weight-bearing movements. The bony landmarks of the ankle include the medial malleolus (distal tibia), lateral malleolus (distal fibula), and calcaneus (heel bone). They should be palpated and viewed when one is performing a structural analysis and/or measuring leg lengths.

FIGURE 1.25 **Bones of the Foot**

CONNECTORS OF THE SKELETON

Recall that the skeleton is made up of 206 bones that are adjoined by joints, ligaments, cartilage, and periosteum.

- ✦ **Joint or articulation:** any point where two bones meet. The majority of the body's joints are movable, thereby serving the dual purposes of protection and movement.
- ✦ **Ligament:** a band of connective tissue that attaches bone to bone. Its main function is to stabilize joints and limit motion. A ligament is tough and resilient depending on the mechanical stress applied to it. The interweaving, fibrous, and slightly elastic tissues forming a ligament provide the structural stability a joint needs for protection against excessive movements that can damage the integrity of the joint structure.
- ✦ **Cartilage:** a connective tissue that mostly forms around joints. There are three classifications of cartilage: *Hyaline* is a "rubbery" matrix that wraps around articular surfaces of long bones. *Fibrous*, which is strong and rigid, is located between the vertebral bodies to form the intervertebral disks and adjoin the pubic bones (pubic symphysis). *Elastic* maintains the shape that forms the external ear. Cartilage has no blood supply, so exercise (especially non-weight-bearing exercise) is important to both its nutrition and waste removal.
- ✦ **Periosteum:** a layered sheath that covers bones. Periosteum forms a strong attachment connecting the muscle, tendon, and bone.
- ✦ **Tendon:** a fibrous band that attaches muscle to bone. The main function is transmitting the force created by the muscle to the bone for controlled movement. A tendon is tough, fibrous, and flexible. At the site where a tendon touches bone, the tendon fibers gradually interlock with the periosteum and meld with the bone, providing a strong connector between the muscle and the bone. For example, many tendons of the ankle and wrist are encompassed within a tendinous sheath that is lined with synovial fluid. The tendinous sheath provides the tendons

of the ankle and wrist the ability to slide easily over bony landmarks. This aids in the protection of the bone by reducing friction during movements. (See Figures 1.26 and 1.27.)

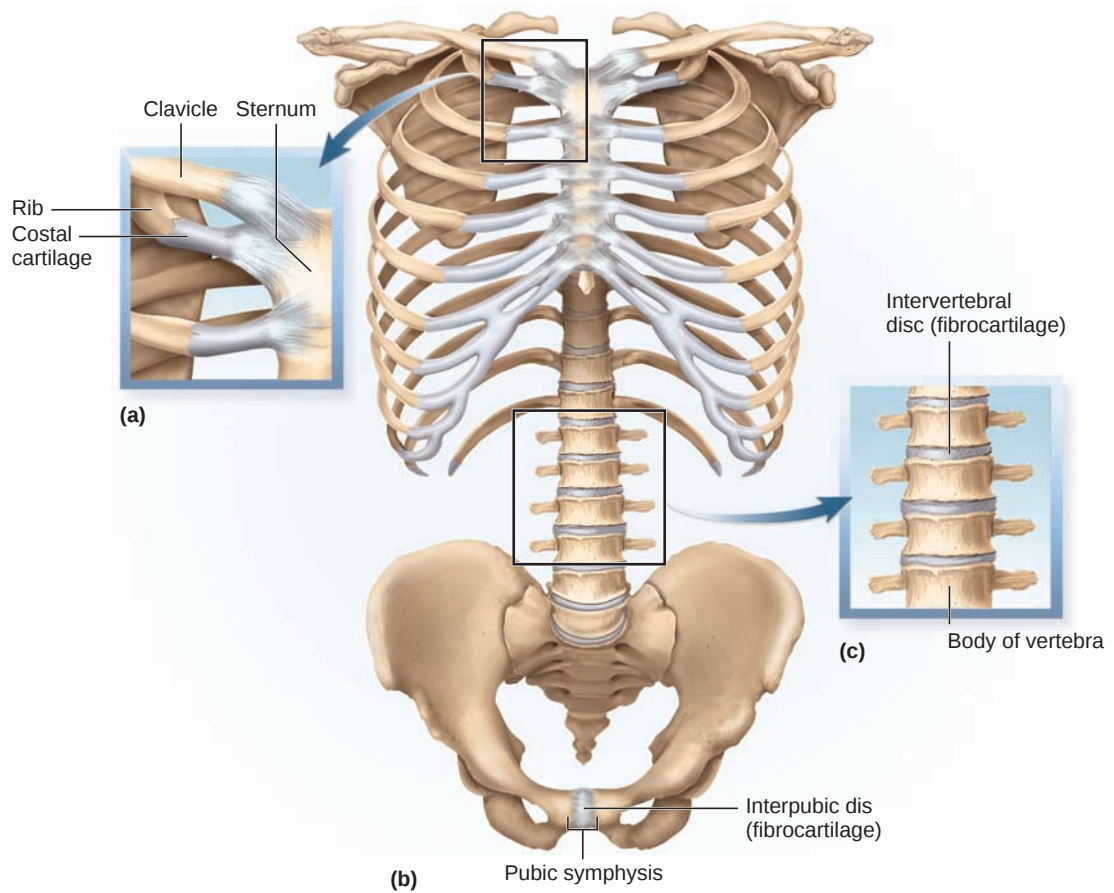


FIGURE 1.26 **Cartilaginous Joints**

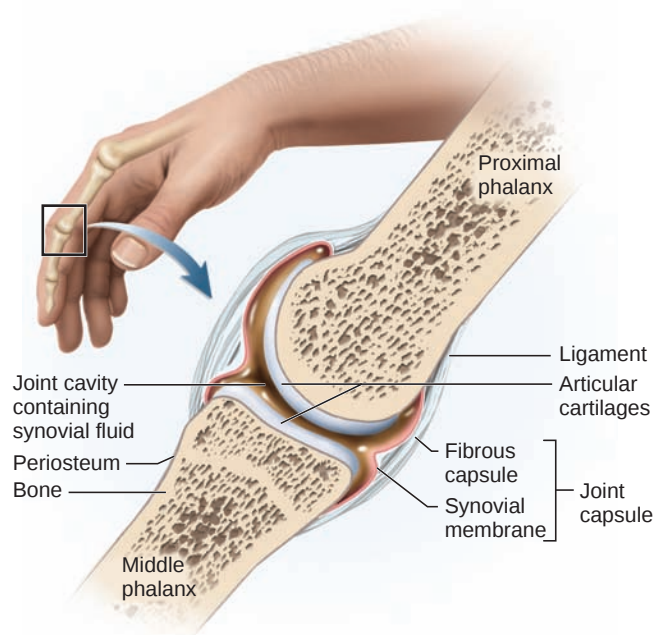


FIGURE 1.27 **Simple Synovial Joint**

BRIEF SUMMARY

In clinical massage therapy education, the bones and landmarks are the best place to start learning about the body and its complexities, since the skeletal system is the foundation that supports the weight of the body, protects the vital internal organs, and provides a place for enhancing palpatory skills for muscle identification.

The skeleton is the structural framework that outlines, supports, and protects the body. Surface landmarks are essential for students to learn because they help build an understanding of where and how the muscles attach. The skull, vertebral column, and rib cage form the axial skeleton; the combination of the shoulder girdle and pelvic girdle and the upper and lower extremities forms the appendicular skeleton. The skeleton is adjoined by joints, ligaments, cartilage, and periosteum that stabilize, anchor, and assist the articulating bones for friction-free movement.

REVIEW QUESTIONS

1. List and identify the bones of the axial and appendicular divisions of the skeleton.

2. Name, identify, and explain the C1 and C2 vertebrae and the specific joints and movements that occur within the articulations of the skull and C1 and C2.

3. Explain the anatomy and functions of the intervertebral, or spinal, disks.

4. What are the functions of costal cartilage?

5. The radius and humerus join laterally to form the pivot joint of the elbow, which allows the radius to pivot around the ulna for _____ movements such as _____ and _____.

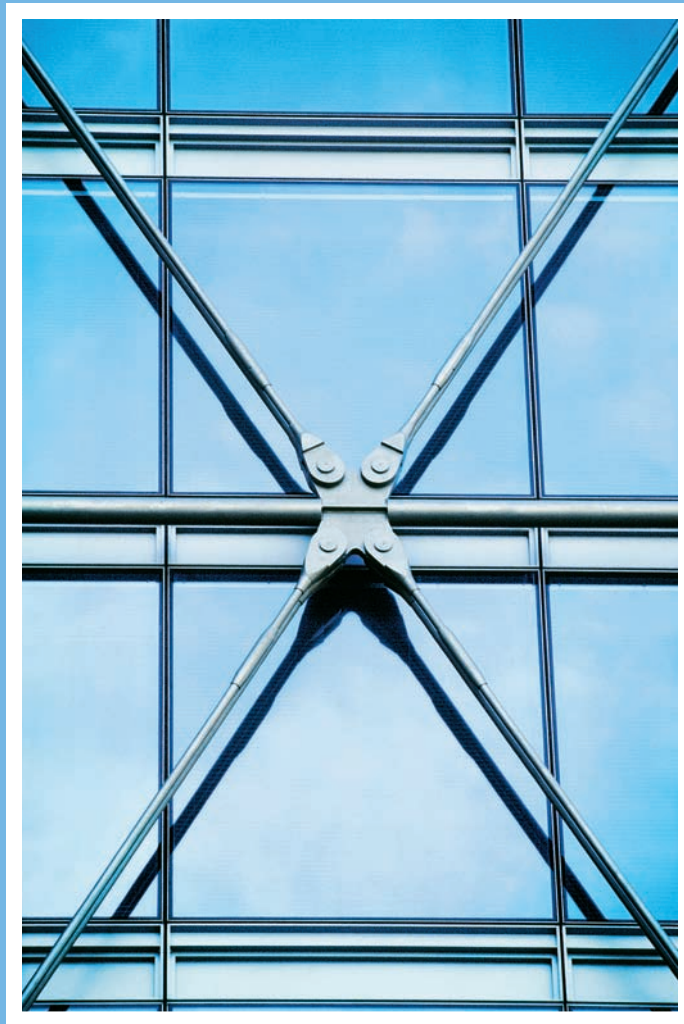
6. The pelvis has two pelvic bones, each having three parts: ilium, ischium, and pubis. The ilium articulates posteriorly and medially with the sacrum to form what?

7. The iliac crest is located at the level of the waist laterally and contours the superior perimeter of the pelvis. Name and identify the three important bony landmarks of the ilium for evaluating posture and for identifying muscles.

8. The three parts of the pelvic bone intersect and form what?

9. Name and identify the bony landmark that is located on the medial-distal end of the tibia and is important for evaluating leg lengths.

10. The skeleton is a living system made up of 206 bones. List the functions of the skeleton.



CHAPTER 2
STRUCTURAL ANALYSIS AND
POSTURAL ASSESSMENT

LEARNING OUTCOMES

After completing this chapter, you will be able to:

- 2.1 List and describe the three planes of the body.
- 2.2 Name the body's landmarks, where imaginary lines bisect on the frontal, sagittal, and transverse planes.
- 2.3 Compare the different characteristics of muscular adaptation and muscular compensation.
- 2.4 List some determining factors that impact the strategy and intensity of a treatment plan.
- 2.5 Understand how to conduct an initial client interview.
- 2.6 Explain why longer sessions are more beneficial than shorter sessions.
- 2.7 Describe the five main elements of the postural assessment phase.
- 2.8 Describe a downward, collapsed "stooped" posture and locate its primary pulls of tension.
- 2.9 Describe an upward, elevated "arched" posture and locate its primary pulls of tension.
- 2.10 Discuss a functional C-curve scoliosis and locate its primary pulls of tension.
- 2.11 Discuss a functional S-curve scoliosis and locate its primary pulls of tension.

OVERVIEW

This chapter serves as the basis for understanding the many complexities and underlying causes of a client's pain. It offers valuable insight into how the bones and muscles interact with one another and how gravitational forces play a major role in maintaining efficient and inefficient postures. Learning structural analysis and postural assessment is the key to determining the correct treatment plan for restoring muscular balance.

STRUCTURAL ANALYSIS

Orthopedic (medical) and osteopathic literature has often said that one's success in athletics or in other physical activities has to do with dealing effectively and efficiently with the forces of gravity on the body. To a lesser extent, particularly in orthodox literature, it has also been suggested that one's mental and emotional health is somewhat dependent on one's physical relationship to gravity.

One of the many functions of effective bodywork is helping a client discover how to reclaim this proper and natural relationship to gravity, much of which is often lost early in life. This includes removing many of the neuromuscular, myofascial, and musculoskeletal conditionings and habits that obstruct the operation of the body. Most little children have proper posture and practice fluid movement innately, thanks to the natural forces that are built into the body at birth. A lifetime of accumulating tensions, stresses, and negative habits interferes with these natural forces, although some children lose their unconscious relationship to gravity at a very young age.

Structural analysis is the in-depth application of physics and geometry to observe and understand how structures work (i.e., what causes an object to stand upright). For example, in the human body, internal forces of muscular pull, leverage of the bones, and hydrostatic pressure interact with the external forces of gravity or other pressures exerted on the body. The quality of this interaction, in great part, determines one's ability to maintain proper posture effortlessly, as well as practice energetic, fluid movement and maintain healthy physical and mental attitudes. Although much on this topic falls outside the scope of this textbook, the foundations of structural analysis are discussed in this and other chapters.

POSTURAL ASSESSMENT

Postural assessment applies the concepts of structural force to discover which pulls of muscular tension are distorting or otherwise interfering with posture and movement. Learning to identify these relationships builds the foundation for effective postural assessment, the elements of which are discussed later in this chapter. This chapter examines the basic anatomical position, the body planes of reference, and the common directional terms (such as *anterior* and *posterior*); these are the foundational elements for understanding the strategies of structural analysis and postural assessment.



FIGURE 2.1 **Anatomical Position**

First, it is necessary to establish and define the anatomical position, which provides a standard frame of reference when one is performing a structural analysis and postural assessment of a client. **Anatomical position** is defined as standing straight with the feet flat on the floor, legs slightly apart, arms hanging freely at the sides, palms facing forward (supinated), and head and eyes facing straight ahead. (See Figure 2.1.)

When observing a client, visualize the planes of the body. The planes are imaginary lines passing through the body from one end or side to the other. The three anatomical planes of reference are the sagittal, the frontal, and the transverse planes. The **sagittal**, or **midsagittal**, **plane** separates the body into left and right sides. On the **anterior** view (viewed from the front), the imaginary line of the sagittal plane bisects the tip of the nose, manubrium, body, and xiphoid process of the sternum and the pubis symphysis. On the **posterior** view (viewed from the back), the imaginary line of the sagittal plane bisects the occipital protuberance (a bony outgrowth palpated at midline just above the base of the occiput); the spinous processes of the entire vertebral column, including the midline ridges of the sacrum; the tip of the coccyx; and the midpoint between the ankles.

The **frontal**, or **coronal**, **plane** separates the body into anterior and posterior (front and back) sides. The imaginary line (viewed from either side) bisects the ear (external acoustic meatus), shoulder (glenohumeral joint), crest of the ilium (highest point), knee (lateral epicondyle of the femur), and anterior (front) edge of the lateral malleolus of the fibula (the prominent bone on the outside of the ankle).

The **transverse**, or **horizontal**, **plane** separates the body into two levels: the superior (upper) and the inferior (lower). This plane can be visualized at any level of the body. (See Figure 2.2.)

Positional terms will always be the universal points of reference that describe the position of one body structure as it relates to another, no matter what position the client is in at any given moment. Table 2.1 lists the positional terms in human anatomy.

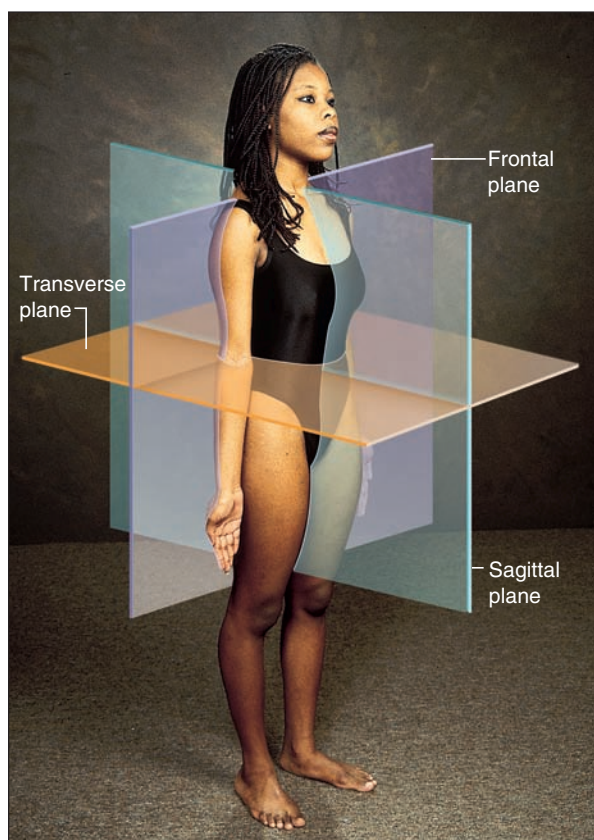


FIGURE 2.2 **Planes of Reference**

ANATOMY OF BONE AND MUSCLE RELATIONSHIP

Learning the bone structures and how they interconnect by way of muscle-tendon tissues is important when viewing and palpating the skeletal body. Learning how to view and palpate the bone structures while performing a postural assessment (based on one's developing skills of structural analysis) will form the building blocks for learning about muscular imbalances and postural distortions.

As a starting point, the bones on the left side of the body should be level with those on the right. When performing a postural assessment, the bones on each side should be palpated, viewed, and compared for bilateral symmetry. Bilateral symmetry should reveal a mirror image of levelness at the bony landmarks of the ankles; the anterior superior iliac spines (ASISs); the crests of the iliums; and above at the shoulder girdles. When these areas are not level, this generally indicates a functional imbalance.

TABLE 2.1 **Positional Terms in Human Anatomy**

Term	Meaning	Example of Usage
Anterior	Located toward or near the front side* of the body	The sternum is anterior to the spine.
Posterior	Located toward or near the back side* of the body	The spine is posterior to the sternum.
Superior	Above in relation to another structure; toward the head	The head is superior to the rib cage.
Inferior	Below in relation to another structure; toward the feet	The rib cage is inferior to the head.
Medial	Toward the middle or center of the body	The spine is medial to the ribs.
Lateral	Away from the middle or center of the body	The ribs are lateral to the spine.
Proximal	Closer to the center or middle of the body or trunk	The elbow is proximal to the wrist.
Proximate	Immediate or next to	The forearm is proximate to the elbow.
Distal	Farther from the center or middle of the body	The fingers are distal to the hand.
Superficial	Closer to the surface of the body	The skin is superficial to the muscles.
Deep	Farther from the body surface	The bones are deep to the muscles.
Supine	Lying on the back or face-up	The client is lying supine on the table.
Prone	Lying on the front or face-down	The client is lying prone on the table.

*In humans only; definition differs for other animals.

It is necessary for therapists in clinical massage therapy and structural bodywork training to have advanced palpatory skills when practicing techniques. The area of focus in decreasing chronic excessive nerve and muscle tension will almost always be in the myofascia, primarily the muscle bellies. When learning the muscles and their actions, the therapist will use the bones and their distinctive landmarks as palpatory guides to help with identifying, isolating, and distinguishing which muscles may require treatment. For example, the spine of the scapula is a bony landmark that can easily be palpated; it is used to identify and isolate two muscles of the rotator cuff. The supraspinatus muscle (*supra* means “superior to or above”) originates superior to the spine of the scapula; the infraspinatus muscle originates inferior to the spine of the scapula (*infra* means “inferior to or below”).

Another example is the quadratus lumborum, a muscle in the lumbar region that may require that a client lie on the side. Lying sideline allows the therapist to isolate the muscle and its attachments.

Knowing where to place and properly angle the hands to directly isolate a specific muscle and its fibers will require knowing the exact location of the muscle tendon attachments. The bones guide the therapist to the landmarks; the landmarks guide to the tendons; and the tendons guide to the muscle bellies. The action of a muscle is to create a contractive or pulling force that is delivered through the tendon to the bone, creating movement. All movement and action is a result of the contraction or relaxation of cellular action and each muscle's discrete group of muscle fibers. It is the job of the soft-tissue therapist to discover which groups of muscle fibers are causing trouble for the client and then reduce the excess muscle and nerve tension contributing to those troubles.

POSTURAL AND FUNCTIONAL KINESIOLOGY

Postural kinesiology is simply the study of how body posture opposes gravity, whether efficiently or inefficiently, and *functional kinesiology* is the study of what happens to a bone when a muscle contracts. Although intimately involved with each other, postural kinesiology and functional kinesiology have somewhat different effects on the body. A vertically balanced posture reflects the ease with which one maintains balance while efficiently working with gravity. Function reflects the ease with which one is able to move effectively, fluidly, and energetically while expending the least amount of energy.

POSTURAL KINESIOLOGY

Postural kinesiology focuses on *twists, tilts, rotations, muscular imbalances, and skeletal deviations*. Twists, tilts, and rotations are combinations of deviations (moving away from a designated normal, vertical posture) in which the bones move forward or backward, side to side, or away from a vertically balanced posture. Each deviated segment either leans or rotates off-plane (sagittal, frontal, and transverse) and subsequently undergoes chronic compression. A symmetrically compressed body does not necessarily show obvious postural misalignments; therefore, more overt postural distortions are easier to work with, as they provide more visible clues. The skin, fasciae, and musculature also do not necessarily and accurately reflect the position of the bone structure (e.g., lumbar lordosis, forward or anterior tilt of pelvis). Initially, palpating the bone structures and landmarks will provide guidance for the therapist to perform a structural analysis. Learning the precise locations of the muscles and their actions that directly or indirectly affect the joints and their movements will provide the knowledge and skills necessary to identify many underlying causes that produce muscular restrictions, imbalances, and distortions that manifest as recurring and often chronic pain.

Analyzing bilateral discrepancies such as unevenness of leg lengths, pelvic tilts, spinal curves and rotations, and levelness of shoulder girdles in all anatomical planes will assist the therapist in formulating a proper treatment plan for addressing the muscular imbalances that cause postural distortions.

MUSCLE AND SKELETAL COMPENSATION

ADAPTATIONS AND COMPENSATIONS

In a healthy symmetrical body, all the above planes or lines are perfectly vertical or horizontal. In addition, joint movements are fluid, with full range of motion. If they are not fluid, this indicates that a muscular interference is affecting the quality and mobility of joint movement. The muscular

involvements usually initiate as **adaptations**, such as shortening the muscles on the left side of the neck (adaptive shortening) to cradle a telephone. At the same time, the muscles on the right side of the neck adaptively lengthen to allow the movement of the neck, plus they increase their pulling power to hold the head up against the downward force of gravity on the left side. The paradox that causes many to error in postural assessment is that while the muscle on the right is lengthening (which would imply relaxation), it is also increasing its tension, as it has to hold the head up against the force of gravity pulling down on the left. Learning to visualize and process such seeming paradoxes is the essence of masterful postural assessment.

If this imbalanced left-right adaptive action becomes habitual, the associated muscular contractions become chronic. The adaptively shortened muscles become the primary contractors, locked short. The adaptively lengthened muscles become the secondary contractors, locked long. More often than not, it is the locked-long muscles that are most painful for the client. The full range of modifications or reactions to conditions of the body can also be referred to as **compensations**.

Another type of compensation is exemplified by a pebble stuck in one's shoe. The client will walk in a way to keep the weight off the affected foot as much as possible, contracting various muscles to keep the weight shifted to the other foot. This, of course, involves adaptive shortening and lengthening of various muscles. If the pebble is not soon removed from the shoe, the adaptations eventually become habitual and chronic or perpetually compensatory in nature.

In an automobile accident, many adaptations and compensations occur at once in the same instant; this is a protective action. The force of the protective action can be powerful enough to establish a habitual compensation in that moment in time.

Practicing skills of palpating the bone structures and examining their relationships to the planes of the body will serve as the foundation for learning structural analysis. Muscle and skeletal compensations occur in all postural distortions. Functional (muscular) or structural (skeletal) irregularities (misalignments and compressions) alter the relationships among body parts and the effect of one body part on another. This altering of the **kinetic chain** is an automatic response that compensates for deficiencies originating elsewhere in the musculoskeletal body. The word *kinetic* literally means "with movement" or "relating to or resulting from movement." The term *kinetic chain* refers to the effect from body part to body part as movement traverses through the body, from bone and joint segment to segment. An example of this is a leg-length discrepancy in which one leg length is shorter than the other. The improper healing of a weight-bearing bone (structural), such as a bone fracture creating improper alignment, or a congenital defect originating from birth and affecting bone growth and length, will have a compensatory effect.

Functional imbalance of the muscles on one side of the spine that are "stuck" or locked short has a direct impact on the opposing muscles on the opposite side; it causes them to countertighten in the body's effort to realign itself over the center of gravity that bisects the midsagittal plane. Functionally or structurally each affects the other. The complex system of cables (muscle-tendon units), pulleys (retinacula), pivots (joints), and levers (bones) of the body continuously attempts to correct itself in order to bring the body to an upright position and maintain that position. Muscle imbalances, poor posture, and soft-tissue pain are the root causes of many afflictions that negatively impact many people; unfortunately, some of these causes are often overlooked.

THE IMPACT OF STRUCTURAL IMBALANCE

For most people, a lifetime of sitting—in chairs, car seats, couches; at computers, work tables, kitchen sinks; and so on—has the same effect: the shortening of the lumbar flexors and hip extensors. There are some, but not many, exceptions: gymnasts, dancers (especially ballet), and yoga teachers, for example. Yet even those who *appear* to have the opposite postural configuration are often masking problems similar to those of the majority; however, these cases require more skill to assess.

Generally, the structurally homeostatic forces in the human body always attempt to keep the head as vertical as possible and the eyes as horizontal as possible. For most day-to-day posture, movement, and action, much of what happens below the head has to do with maintaining these two relationships.

The human head continually, automatically, and naturally attempts to maintain a vertical balance: eyes looking straight out, if level with horizon, and eyes horizontal from left to right or parallel with the horizon. Horizontal balance of the head (the eyes) is best viewed from the front. Vertical balance is viewed from the side to observe how much the head has to tilt to stay level with the horizon.

The frontal plane (viewing from the side) reveals much of the overall impact that gravity has on the body, particularly in the elderly. Poor, inefficient posture is often the result of excessive muscle and nerve tension caused by chronically short hip extensor (hamstring and gluteal) muscles (Chapter 6). When these muscles are chronically short, the pelvis rotates posteriorly, flattening the lumbar curve. The flattening or loss of the lumbar curve (hypolordosis) causes the upper body (torso, thoracic spine, neck, and head) to lever forward off the gravitational line quite significantly, shortening the space between the pelvis and the rib cage. As the pelvis and rib cage **proximate** (move closer together), **Davis's law** (which allows no slack in any muscle; see Chapter 3 page 73) causes the abdominal muscles to shorten, contracting to take up the developing slack. This contributes to overall shortening of the abdominal “core” muscles. The shortening of the abdominal muscles (Chapter 7) affects the kinetic chain of muscles that directly attach to the ribs, pulling the rib cage downward. As the rib cage depresses, it tilts downward and forward, bringing the neck and head with it, causing the head to project even farther forward off the gravitational plane.

Before the body automatically compensates, the head looks downward at this point. The natural, posturally stabilizing action of the head then compensates by “rocking back” at the base of the occiput (atlanto-occipital joint)—lifting the eyes back up to horizontal—as a last-ditch effort to bring the head back on the proper frontal plane. The pulling and collapsing effect from shortened hamstring and abdominal muscles, along with the gravitational pull on the body, actually compresses the body, molecule by molecule, tissue by tissue, over a person's lifetime. This is called *downward-collapsed* or *stooped posture*, which causes *forward head-neck posture*, and it is one of the more prevalent postural distortions. It starts a vicious cycle of lumbar and cervical disk compressions; weakening, thinning, and deteriorating of joint structures; compression of blood vessels; and, most noticeably to the client, compressing, impinging, and irritating of the nerves—the start of many myofascial pain syndromes.

CLIENT INTERACTION

The goal of clinical massage therapy and structural bodywork is to reduce chronic, excess muscle and nerve tension and restore proper homeostasis between the neurologic, muscular, fascial, and skeletal systems of the body. The concept of this work is to incorporate a range of styles and methods within the therapy session that cultivate the client's ability to release his chronic tension patterns by focusing awareness on his unhealthy neuromuscular habits, imbalances, and restrictions.

CLIENT SELF-AWARENESS AND EDUCATION

Educating the client is an important part of any session. Ideally, the client should be an active participant during the bodywork session, consciously aware of and communicating about the amount of therapeutic and manual pressure needed to keep the client in her comfort zone. Educating the client about how to receive manual pressure and communicate will also help focus her awareness on the muscles being treated.

The first step for the massage therapist is to develop a therapy approach and plan to meet the client's objectives and goals. Setting forth a plan of action allows the therapist to reach realistic goals within each therapy session. The therapist should always keep in mind that the strategy, techniques, and intensity of the treatment plan depend on, among other possibilities:

- ✦ *The cumulative amount of chronic, excess muscle and nerve tension (CEM&NT):* facilitated, tight, ischemic, shortened, hardened, lack of pliability?
- ✦ *Type of pain:* sharp, electrical, burning, dull, throbbing, unilateral, bilateral?
- ✦ *Location of pain:* weight-bearing or non-weight-bearing?
- ✦ *Intensity and frequency of pain:* acute or chronic?
- ✦ *Duration of the condition:* hours, days, weeks, months, or years?
- ✦ *Amount of muscular imbalances and joint restrictions:* stiff, stuck, or locked?
- ✦ *Degree of postural distortion:* uneven leg lengths, pelvic tilts, scoliosis?
- ✦ *Previous traumatic experiences:* auto accident, sports injury, abuse, and so on?
- ✦ *Rate at which the client's body heals:* age, stress factors, and immune function?
- ✦ *Perpetuating postures at the workplace:* fixed, sitting, standing, repetitive actions, sustained twisting?
- ✦ *Flexibility:* poor, fair, good, or excellent?
- ✦ *Genetics:* constitutional factors and family history?
- ✦ *Nutritional values:* diet, smoking, caffeine, sugar?
- ✦ *General state of health stress factors:* mental, physical, emotional, and so on?
- ✦ *Level of commitment to wellness:* motivated or unmotivated to stretch and exercise?

CLIENT INTERVIEW

Initially, during the client interview, the therapist should ascertain from the client why he has sought treatment and what he hopes to gain. It is important to learn about the client's history; what, if any, traumas the client has experienced; what diagnostic evaluations and procedures the

client has undergone or is currently receiving; surgeries and medications; who the client's primary health care provider is and the modality (medical, chiropractic, osteopathic, naturopathic, etc.); what kind of exercises and stretching the client has or has not done; and the client's physical and mental inhibitions.

While it is important for the therapist to know the client for the benefit of the work, the most emphasis should be placed on helping the client get to know himself and remember factors or events that contribute or have contributed to his condition. This is the basic principle of the **homeopathic interviewing** process. The practice of homeopathy contains a number of elements that can serve as effective guidelines for soft-tissue therapy. "Response-able" change starts just by getting the client to reown the past and the unacknowledged present.

Initially, the most important question for a client is: "When this bodywork session is over, what would have to happen for you to know this session was a success?" By this time, the therapist should have discovered whether the client was only looking for a "quick fix" or was interested in the wider scope of what the work has to offer. The idea is not to rely on a preexisting, systematic recipe. Indeed, what works for one may not work for all. This approach does not rely on a set number of sessions or standard procedures based on the type, length, and severity of the client's condition. Instead, the goal is to give the client a greater sense of self-awareness and a reference point with which he can evaluate the therapist's work, as well as the therapist's ability to relate to him. The therapist should clearly communicate her goals related to the treatment before ending this part of the session. Additionally, the therapist may have to ask the client to adjust his expectations if, for instance, an expectation falls outside the scope of the therapist's ability. If the expected outcome appears to fall completely outside the therapist's skill level, the therapist may allow the client to choose whether he wants to continue with the treatment or be referred to a more experienced practitioner.

At some point during the interview process, the therapist should describe to the client what will take place throughout the rest of the session, as well as explain that longer sessions produce far better results than typical 30- or 60-minute sessions, particularly when the focus is clinical and structural bodywork.

The therapist should also explain that during every session the muscles and their respective compartments are examined thoroughly to determine which are locked short and that this will be the primary focus of treatment. It is also important for the client to understand that a 2-hour session once a week is more effective than two or three 1-hour sessions per week for treating pain and distortion. The therapist should explain why longer sessions allow a more complete examination and release of all the primary and deeper muscles that link and hold the body in or out of alignment and why achieving better, sustained results requires more time spent on the table for "unlocking" all the postural-related muscles and patterns. In working structurally, releasing one group of primary contractors without releasing other primary contractors can throw them further out of balance and increase pain.

The client should know that it is not the quantity of the sessions but the overall quality and individualized focus of each session that are important. This approach to sessions will save the client time and money because of fewer office visits and a slight reduction in the hourly rate.

A therapist that is goal oriented, with a formulated treatment plan that meets the client's expectations will demonstrate to the client the therapist's:

1. Level of commitment to the client's therapeutic success.
2. Confidence in helping relieve the client's pain and/or dysfunction.
3. Results-driven goals toward the client's well-being.

During the interview process, the client should be informed that a subsequent plan of treatment will be based on his feedback to the therapist during and after each bodywork session; moreover, it is good practice to take one session at a time. This creates constant feedback for both the therapist and the client and allows the client to fully get the most out of each session and feel the changes within his body. Encouraging the client to give honest feedback enables the therapist to modify the strategy, treatment plan, and techniques as necessary for each therapy session.

After completing the first session with the client, the therapist should ask the following questions of the client:

- ✦ What's happening in your body? (What are the positives and negatives?)
- ✦ Do you like my approach and style of bodywork? (Why or why not?)
- ✦ What did and didn't work for you? (What could have been better?)
- ✦ Was your experience sufficiently positive to continue with more sessions?
- ✦ Are you willing to commit to a schedule of 2-hour sessions twice a week for 2 or more weeks?

Establishing a commitment allows the therapist the time and consistency necessary to find the underlying causes of the client's primary complaints.

Scheduling appointments up to 2 weeks in advance will enable the therapist to plan ahead, and this helps maintain efficiency.

As mentioned previously, the objective in asking questions about a client's history, lifestyle, and so on, is that doing so might help determine factors contributing to the client's complaints. This information may either support or conflict with what is found in the physical assessments. Generally, only experience can tell how much these factors influence a treatment plan, as compared to the postural assessments. Often, placing more value on the physical signs following the stages of assessment is likely to produce better results, although there are exceptions, so this is not guaranteed.

THE POSTURAL ASSESSMENT

In this model, there are five stages of postural assessment with commonalities between them. Ask the client to stand in various ways and positions to obtain more information, much of which is aimed at increasing the client's self-awareness. It is essential for the therapist to observe the client's vertical orientation, or lack of it, to understand how the client cooperates with or fights gravity. Since most people generally sit or stand in the field of gravity throughout the day, the client's relationship to gravity can reveal much about what she deals with on an ongoing basis.

New students should become familiar with the various stages described below during the learning process. As time goes on, these stages will cross over each other, and the therapist's skills as an evaluator of posture will gradually enhance.

However, even the most experienced therapists can be fooled, so it is important to refer to the basics on a regular basis.

The Soft-Look Assessment

The *soft-look assessment* begins the moment the client walks through the door. During this assessment, the client is unaware that she is being observed; the therapist, on the other hand, is examining the client's relationship to gravity.

Many aspects of postural assessment are better revealed when the client is not aware that she is under evaluation; assessing in this way is described as “taking a soft look.” Although positioning the client behind a plumb line or in front of a postural grid can be useful, it can also give false readings because the client will be tempted to alter her body to stand up straight, unconsciously lock the knees, suck in the stomach, lift and stick out the chest and head, and look straight ahead. However, maintaining a casual conversation for a minute or two allows the client to relax the body and thus reveal more of the true, inefficient body position and movement in space.

The Relaxed Standing Position

Once in the treatment room, the therapist should have the client stand as naturally as possible with the eyes closed for a moment, and he should coach the client to relax and bring her breathing into the abdominal region. The client should be instructed to let the arms feel heavy and allow her body weight to sink to the pelvis and then to the feet; the client should then focus on the way the body feels at that moment. The therapist should ask the client to relax as much as possible without falling over. As the client begins “feeling the experience” of stillness and awareness, the therapist should quietly circle the client looking at how the body relates to gravity on the sagittal and coronal planes.

Note:

Keep in mind that the therapist's conclusions related to any assessment may be flawed yet still bring about a client's improvement; this is because a client's body will still relax to some degree during treatment and yield positive results. This is the *law of generalization* in reverse. The law of generalization says that excess irritation from the periphery of the body to the tonus system—the reticular formation (see Chapter 5)—will cause irritation and symptomology in susceptible areas of the body. Effective soft-tissue therapy, even if misguided in strategy, can inhibit excess irritation in the tonus system, thereby reducing the overall irritation and symptomology in the whole body.

The vast majority of soft-tissue treatments work well because of this generalized release of tension. Additionally, many people have localized issues that can be effectively treated with direct pressure in a few sessions. Others must keep returning on a regular basis to get relief. Some people feel worse after therapy, and it is this small percentage of afflicted people who need more specific treatment. For these clients, an error in assessment can leave them very uncomfortable or in more pain following treatment. The challenge is determining which patients have specific needs. A key to determining this during the postural assessment is not to immediately look at the external factors, such as the contours of the flesh, which shoulder is higher, or whether there exists significant lumbar lordosis. These signs can be misleading and are often the opposite of reality. Instead, start with the orientation of the pelvis and work outward, upward, and downward from there. For example, the flesh over the pelvis and hips can give the appearance of one hip being higher than the other, yet palpating the hip bones may reveal that the one hip is actually much *lower* than the other.

Another common error is that one shoulder (the left side, for example) may appear higher when the rib cage is pulling down on the opposite side (the right side) because of shortened oblique muscles on the right side of the waist. Many therapists have tried to get what they believed was a high shoulder to go down when what was actually needed was to get the rib cage on the opposite side to go up—the shoulders would have then leveled out without having to touch them at all. In this case, from a postural assessment point of view, the shoulders were perfectly horizontal *relative to the rib cage*; however, it was the rib cage that was tilted to one side. Looking only at the shoulders relative to the horizon, therefore, did not provide the necessary information.

These types of illusions are common. The key is to look not just at the muscles and flesh, and not only at where the bones are in space, but also at where they are in relation to each other. To further illustrate, countless people have been told that they have significant excess lumbar lordosis with an anterior tilted pelvis. But if a therapist were to palpate the actual lumbar vertebrae, which is easy to do from the rear, it would be discovered that many of these people actually have a significant loss of lumbar curve, all appearances notwithstanding. A few even have posterior protruding vertebrae—the exact opposite of lumbar lordosis. Treating the nonlordosis with the standard approaches will actually put severe excess compression on the lumbar disks, leading to possible herniation. So the potential consequences of misinformation here are quite significant.

Many therapists rely on the goniometer, a device designed to check the angle of tilt of the pelvis from anterior to posterior landmarks. While this tool might be accurate in many cases, it is not reliable for clients whose pelvic landmarks do not fit within the normal range. Relying on the goniometer to determine pelvic tilt has led to incorrectly treating many people. Therefore, goniometer measurements should be confirmed by x-ray or through other assessment procedures.

Part of the art and science of postural assessment is to be able to look at the bone structure separately from the skin, muscles, and fasciae, which are often misleading. Even without x-rays, a surprising amount of information can be gleaned by learning to palpate the bones.

The Central Position

Next, the therapist should ask the client to stand with the feet as close together as possible, even if the client feels a bit unstable. The client should stand with the feet pointed in the directions that feel most natural, even if these positions are different for each foot or are not parallel or straight ahead. If the feet are not parallel, the therapist should instruct the client to look down and should then assist in reading the direction of rotation of the feet. This creates a more or less stable “home position,” or point of reference, for the client during the session; ideally, the client will more readily feel potential changes happening in the body. The client may or may not feel changes, but some people are desensitized to the process and will ultimately have to take the therapist’s word that changes are occurring. Several questions the therapist should ask include:

- ✦ Do you feel stable?
- ✦ If not, which way are you leaning or swaying?
- ✦ Is there more weight on the balls of the feet or the heels?
- ✦ Is there more weight on the left foot or right foot?

- Does one knee feel more locked or straighter than the other?
- Which shoulder feels higher?

Anything the therapist notices is subject to asking a question that helps evoke the client's attention. The therapist should also notice and point out other possibilities, as discussed below:

- If the client's feet are pointing in one direction but the torso is pointing off to the right or the left, ask the client if he or she can feel the difference. Have the client look down and see the difference. (The internal or external rotators or the flexors or extensors of the hips could be imbalanced, just to name two possibilities.) In very complex cases, the feet point one way, the hips another, the torso another, and the head even another. (In this type of situation, it is suggested to start from the bottom and work upward.)
- Are the client's feet pointing in the same direction as the knees? If not, there may be rotation from the knee down. Too often, it is assumed that feet pointed outward or inward are due to overshortening of the lateral or medial rotators of the hips; however, quite often the knees are pointed comfortably and naturally straight ahead while only the feet turn in or out. In such cases, it is the lateral or medial rotators of the leg—meaning from the knee down—that are the problem. Also note that in orthodox medical terminology, the “upper leg” and “lower leg” are referred to as the *thigh* and the *leg*. These are the types of linguistic distinctions a therapist must take into account when speaking with a client as opposed to a medical professional.
- Is one arm hanging closer to the hips than the other? If so, can the client feel or see the difference? This condition could be due to one of several factors, including a side shift of the pelvis, indicating an adductor-abductor imbalance; a side shift of the rib cage, indicating a quadratus lumborum; an internal-external oblique imbalance; a latissimus dorsi imbalance; or a shoulder girdle imbalance, just to name a few. It could also be due to a combination of factors.
- If the elbows are rotated outward or inward, help the client feel or see this. Elbows should point straight back. If they are pointed out, the medial rotators of the humerus are overshortened; if they are rotated inward, it is the lateral rotators of the humerus that are overshortened.

While the list could go on and on, learning the “normal” anatomical positioning gives therapists the tools they need to make assessments. Studying advanced structural anatomy and postural and functional kinesiology will refine the student's skills in this vital part of therapy. The anatomy helps determine the exact location of each muscle or part of a muscle. The kinesiology helps determine the exact action a muscle or part of a muscle performs. This helps determine which muscles are locked short (the primary cause) and which muscles are locked long (the usual location of the pain or most noticeable dysfunction).

While this information is important to you, the therapist, it is even more important to the client so that she can begin to feel her body differently and more completely than she did before. During and after the session, the client will be able to “check in” with herself to see and feel the gains, as well as how well she is maintaining the work or how quickly she is losing it.

Common Elements of Postural Assessment

In the process of asking the questions listed earlier, observe the client from the front and side views, noting the positioning of the various joints on the vertical lines:

- ✦ On the midsagittal plane (viewed from the front), the gravitational line should bisect the nose, sternum, and pubis symphysis. The head should be centered, and the shoulders and pelvis should be level and the weight of the body distributed equally on each foot. Move around to the back and note if there are any differences in appearance, which there often are. It is also possible to observe the spinal curves here, as well, without x-rays.
- ✦ On the frontal plane (viewed from the side), the gravitational line should bisect the ear, the head of the humerus, the greater trochanter of the femur, the lateral condyle of the tibia, and the front edge of the lateral malleolus of the fibula at the ankle. Some people actually look different from one side to the other, indicating rotations on the vertical axis.

Palpate the space between the tops of the hips and the bottom of the rib cage, just below the 12th rib, toward the back of the torso. The purpose of doing this is to look for a gauge as to how much space the client has between the ribs and hips; this is a very important measurement that helps show how much shortening of the abdominal wall the client has accumulated (for many people this shortening is substantial). For many therapists, this is one of the elements of postural evaluation that is best learned in a live setting. This is also the opportunity to check whether one hip is higher than the other by palpating with the fingers of each hand on top of each hip.

If these views are inconclusive and still more information is needed, ask the client to stand as if he were at a cocktail party, with weight more on one leg or the other; then ask with weight more on one leg and then on the other which feels more natural or comfortable. Note which hip the client leans toward and lifts up, which knee he bends, and whether he turns one foot out more than the other. This alone can give vital clues to the relationships between many muscle pairs, such as the adductors and abductors, and the lateral lumbar muscles (the *quadratus lumborum* area).

Take mental notes and chart them in the client's file. After a session or two, revisit the file and compare the before-and-after objectives, findings, and results. Subsequent treatment plans will be determined from the client's feedback on how he responded to the initial session and each therapy session thereafter. Before each therapy session reevaluate the client and continue the plan of introducing new areas to be worked on and balanced.

All this information gathering provides the visual references necessary to help determine which muscles—the primary contractors—need to be released to begin the process of “unwinding” the body. During the learning process, it is helpful to stand the client up after every move or two to see, and get feedback on, what is happening with each change in the body's musculature. The client will also benefit by feeling how these changes affect his body. For example, if the abdominal muscles are released and the client then stands up, he will often feel dramatic changes in the neck or shoulders. After that point, when the neck hurts, the client will be less inclined to think of the neck and will focus instead on the real problem, which for many is the overshortened abdominal muscles and for others is the hamstrings or gluteals.

The Table Assessment

To perform the table assessment, position the client on the table face-up. The first step is to grasp underneath the client's heels and perform slight tractioning of the legs, simultaneously swaying them back and forth to assist the body in relaxing and realigning itself. This puts the client's body in the proper position for starting the evaluation of the bony landmarks.

The first consideration is to determine whether there is a deviation in leg lengths on the transverse plane. This is done by bringing each of the medial malleoli together and comparing them to see if there are any measurable differences. Moving up the body, place and point each thumb toward each other and evaluate the transverse planes at the levels of the tibial tuberosities, the anterior superior iliac spines (ASISs), and the iliac crests. This will give you a visual reference of how the bones of one side of the body compare to the other side. Palpating and comparing landmarks of the lower extremities and pelvic bones first will provide a reasonably good idea of what the foundation of the body is doing and what the vertebral column is sitting on and sitting in. Valuable information, such as determining whether spinal curvature is present, can be gained while the client is face-down. Positioning the client face-down with feet hanging off the therapy table allows the therapist to palpate the lumbar spine to see whether the lumbar spine is flat (loss of curve) or dipped (with curve).

A bone-length discrepancy can occur from genetic causes or after a traumatic injury such as a severe and complicated fracture or damage to one of the weight-bearing structures of the skeletal body. If deviations are noted and there is no evidence of actual changes to the bones, this would indicate a muscular imbalance. It is important to note that most so-called leg-length discrepancies are misnamed. Indeed, most are not unequal leg lengths but overshortened lateral lumbar flexors on one side (primarily the quadratus lumborum, assisted by other local muscles, including an imbalance in the adductors and abductors of the hip), which lift the hip up to create the illusion of a short leg.

True leg-length discrepancy cannot be externally measured with a tape measure. Because of possible deviations at the greater trochanter and deep into the pelvis and hip joint area, the bones must be measured and compared using x-rays. Additionally, comparing apparent leg-length discrepancies when the client is lying down and standing can produce different, sometimes opposite, conclusions.

Often, if a person is wearing an orthotic heel lift to compensate for leg-length differences, the hip will be hiked to the same level as the height of the orthotic while the client is in the standing position. In such cases, dropping the hip through the application of proper soft-tissue therapy techniques that contribute to hiking the hip eliminates the need for the heel lift altogether.

Muscular imbalances resulting from muscular strains, repetitive injuries, habitual poor postural habits, and fixed postural positions, to name a few, are far more common than actual bone-length differences. Musculoskeletal pain will result if muscular imbalances are left untreated and unmanaged.

Continue up the body and evaluate the transverse plane at the level of the inferior borders of the rib cage. On each side, place open hands (palms down) in the space between the iliac crests and the rib cage. Less space on one side often indicates a concave angle of the lumbar spine and shortening

of the muscles on that side; however, in some complex cases, the convex side is on the same side as the short space between rib and hip. Next, place the fingers on the top of the shoulders (acromion processes) on each side and get a visual reading to see if one side of the shoulder girdle is hiked up or pulled down. If the shoulders are not level, this indicates a musculoskeletal imbalance. Lastly, visualize the position of the client's head as it lies on the table. Check to see if the head is tilted toward one shoulder or the other. If it is, this indicates a marked shortening of the muscles on the tilted side.

After completing the postural analysis of the client, map out the concave angles of the body that will require the application of massage therapy techniques. The concave angles are the locations of the primary contractors, the locked-short muscles. The best approach to “leveling out” the body segments is to treat all the muscles of the concave angles and “curves.”

It should be remembered, however, that a curve in the spine is actually a series of angle changes between each vertebra and is not truly a “curved” bone. These treatments may take a long time because all the contracted, locked-short muscles within the concave angles must be eliminated—and there can be many. The primary contractor muscles are often the deepest and must be reached and sufficiently released to have any long-term benefit.

Evaluation via Passive and Active Movement

While performing a range-of-motion assessment, the therapist should instruct the client to actively perform simple range-of-motion movements on all planes of the body. These movements should include flexing, extending, and rotating the spine, as well as adduction, abduction, rotation, and circumduction movements to the ball-and-socket joints. Passively and actively assisting a client's movements will help identify restrictions during a structural analysis. The key here is not necessarily the client's degree of flexibility but the smoothness and ease of movement, the level of coordination and agility, and the comfort or discomfort of movement. Paradoxically, many flexible people have a lot of tension and “rocks and knots” in their muscles, as well as a lot of pain. Although being flexible is beneficial, flexibility should not be confused with relaxation, resilience, and healthy tissues.

TREATMENT ON THE TABLE

Once treatment begins, it is important for the therapist and the client to be attuned to one another. Talk to the client about how to use some of the key words: *deeper*, *less*, and *edge*, as described in Chapter 5. Help the client discover, process, and release the various kinds of resistance she might experience, even if there is no pain or discomfort.

The therapist should help the client get used to the therapist's hands and the techniques, which may feel different than what the client is accustomed to. The therapist's job is to help the client feel her muscles and the tensions within them in new ways, as well as learn how to experience relaxation and let go with her own awareness. This is the essence of psychomuscular release.

The client might not be able to tell that there is tension in a muscle at first. In fact, the client might think she feels tension only when there is pain. The therapist can help the client feel the texture and tensions in the muscles, independently of pain or discomfort, and the differences between

tension and pain. The therapist should aid in helping the client learn to feel tightness, which in this case comes in the form of muscular tension, even if there is no pain.

Eventually, the therapist can coach the client on using the breath to help dissolve tensions. Initially, if the therapist is working with the abdominals, the client will likely feel a spontaneous expansion and slowing of the breath without having to do much except allow the abdominal muscles to relax. This can be a valuable insight: discovering that shortness and shallowness of breath are caused primarily by too-tight abdominal muscles.

When breathing becomes more natural, advise the client to bring the breath “down into” the areas being worked. Obviously, this is not the actual breath; however, there is a definite sensation associated with this technique, which is probably a function of the nervous system and neurotransmitters becoming more active in the area the “breath” is directed to. This can be accomplished by placing your hand on the area of treatment, thereby directing the client’s attention to the area being treated. Many feel that this technique helps increase the rate at which the muscles relax. If the client seems too stressed or disconnected to focus on breathing, the therapist should continue to move ahead, avoiding the maximum edges. If the client appears bored, it is good practice to upgrade the level of intensity until the client’s sensitivity increases and she understands that high intensity of sensation is not always necessary to receive the benefits.

Overly stressed clients might need basic massage before moving to more specific edgework and structural balancing. Once the client has learned the basic principles and has expressed interest in moving forward, the therapist can move into more specific work. This process might take anywhere from 5 minutes to five sessions.

NON-SYMMETRICAL WORK

In many cases, the therapist will not work symmetrically, nor will the therapist often work where the pain is. Instead, the nature of this bodywork involves working selectively on the overshortened muscles and all but ignoring the overlengthened muscles until the client gets close to proper balance. A small amount of work can be done on the overlengthened muscles providing that doing so does not throw the client further out of balance. For instance, if the client’s neck hurts, it may be discovered that the primary contractors causing the neck pain are the abdominal or chest muscles. In time, the client will realize the interconnectedness of the body: that when the abdominals relax and lengthen, the neck stops hurting—even when the neck isn’t the area that is touched. That is the essence of structural balancing.

POSTURES AND RELATIVE PULLS OF TENSION

Many approaches to postural evaluation illustrate just a few limited postural imbalances; this can give rise to a narrow impression of the range of potential distortions and the idea that there aren’t very many. This text presents a few basic models with a caveat: There are many potential variations from these basic reactions of the body.

To determine what is abnormal, or imbalanced, it is first necessary to see what is “normal,” or balanced.



FIGURE 2.3 Example of an Efficient Good Posture

this condition progresses, the bent-over posture can become more pronounced; in extreme cases, it can turn into a hunchback, or dowager's hump.

The primary issue in the early stages is the chronic shortening of the gluteal and hamstring muscles, which create hip extension or posterior tilting (tucking under) of the pelvis that causes the hip joints to drift forward in space. As the pelvis tucks under, this forces the lumbar spine rearward into a flattened position. Also as the pelvis tucks under, the front of the pelvis and pubic bone



FIGURE 2.4 Example of a Downward Stooped, Collapsed Posture

EFFICIENT "GOOD" POSTURE

An efficient good posture aligns the body over the center of gravity (Figure 2.3), allowing gravity to pull equally on all sides of the body. A vertical line bisects the various bony structures of the body, except the lateral malleolus, at which the vertical line passes on the front surface. With this vertically centered orientation, the body works with gravity more efficiently and with less tension and hardship on the nervous, muscular, skeletal, and organ systems.

DOWNWARD COLLAPSED, "STOOPED" POSTURE

A common misalignment of posture that most people, especially the elderly, suffer from is the downward collapsed, "stooped" posture (Figure 2.4). As

this condition progresses, the bent-over posture can become more pronounced; in extreme cases, it can turn into a hunchback, or dowager's hump. The primary issue in the early stages is the chronic shortening of the gluteal and hamstring muscles, which create hip extension or posterior tilting (tucking under) of the pelvis that causes the hip joints to drift forward in space. As the pelvis tucks under, this forces the lumbar spine rearward into a flattened position. Also as the pelvis tucks under, the front of the pelvis and pubic bone must lift, causing the abdominal muscles to shorten by way of Davis's law and take up the slack. As the abdominals shorten, they pull down on the rib cage as well. Next, because of the flattening lumbar spine and shortening abdominals, the rib cage and thoracic spine are levered forward and down, bringing the neck and head forward and down. Usually, the muscles on the back of the neck will shorten to bring the head back up to level. All of this causes the gravitational field to pull more strongly on the front of the body, in turn requiring that the muscles on the back of the body contract, opposing the force of gravity (Figure 2.5). While this may appear to be a case of weak back muscles, it is more likely a case of back muscles that are chronically overlengthened, yet contracted and exhausted, with ischemia; this causes discomfort, aches, and pain.

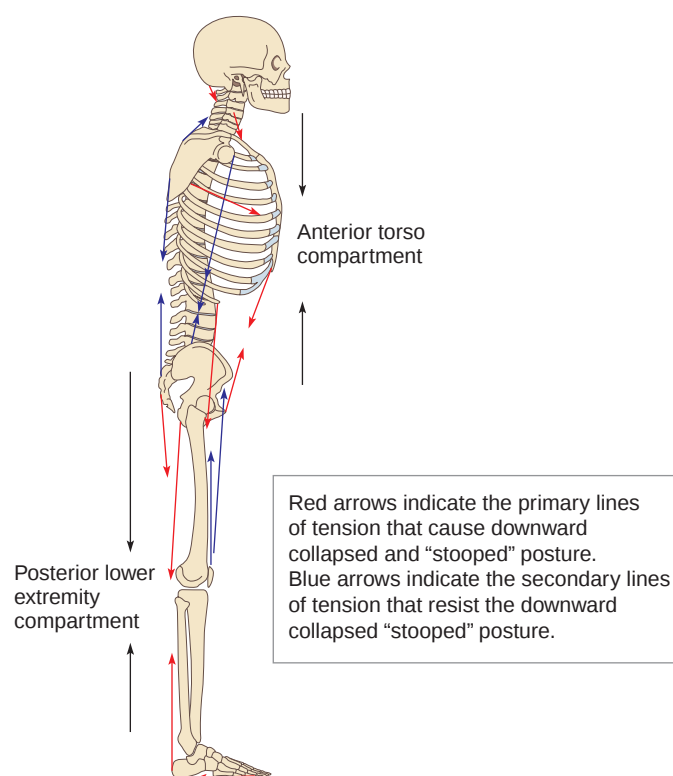


FIGURE 2.5 **Example of Pulls of Tension**

In many individuals, the process starts with the abdominals and moves downward. This depends in part on what kinds of activities the client has participated in, the client's usual posture at work, injuries, and so on. In others, it starts from various places at the same time. It is unwise to make assumptions as to which muscles are primarily responsible until a thorough assessment is made. For example, for a runner postural trouble might start in the hamstrings and gluteals; for a person who does a lot of sit-ups the trouble might start in the abdominals; and for a bicyclist the trouble would start in both areas, especially if the bike has low handlebars.

Some people who tend toward this posture aggressively contract the lower- and upper-back and neck muscles to counter the downward pull of the abdominals and the hamstrings and gluteals. The back muscles are then overstressed from fighting the downward pull of both the shortened muscles and gravity. Also, the shortening of muscles in front and back decreases the space in the torso and spine, compressing the disks and leading to thinning, herniation, or worse. Whether stooping or arching, as seen in frontal distortions (viewed from the side), clients often experience the majority of pain patterns at the midline or running **bilaterally** and **horizontally**, across the body from side to side at the same level.

UPWARD ELEVATED, "ARCHED" POSTURE

The upward elevated, "arched" posture is nearly the opposite of the postural imbalance just discussed, and it is far rarer. It involves shortening of the hip flexors, which produces an anterior tilt of the pelvis and an increase of the lordosis in the lumbar spine (Figure 2.6). As the lumbar



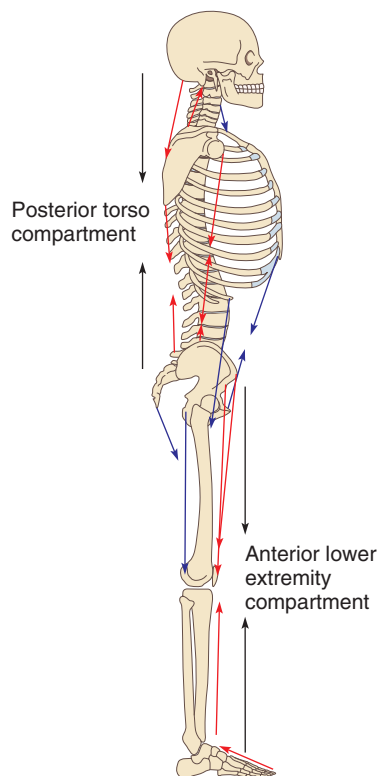
FIGURE 2.6 Example of an Upward Arched, Elevated Posture

lordosis increases, the lumbar erector spinae muscles tend to shorten. As the pelvis tilts forward, the abdominals must lengthen to allow the rib cage and thoracic spine to lift up and back and also move the neck and head up and backward (Figure 2.7). However, due to the physical activities of people with this condition, the erectors will soon overshorten, usually causing a loss of curve in the thoracic spine. There is a higher tendency toward fixation of the facet joints, which interferes with their proper function.

This type of posture is most often seen in dancers, gymnasts, and certain other athletes. Ironically, these individuals often appear to have better, more upright posture than most, yet they have as much or more chronic tension and pain as people with the slouched posture.

Paradoxically, many with this configuration actually have a loss of lumbar curve, even though they maintain an obvious, deep, overall arch in the lower-back region.

It is important to note that there are those who strongly promote the idea that an anterior tilted pelvis is a cause of forward neck and head posture. This anterior pelvic tilt being the cause of forward



Red arrows indicate the primary lines of tension that cause an upward elevated and "arched" posture. Blue arrows indicate the secondary lines of tension that resist an upward elevated "arched" posture.

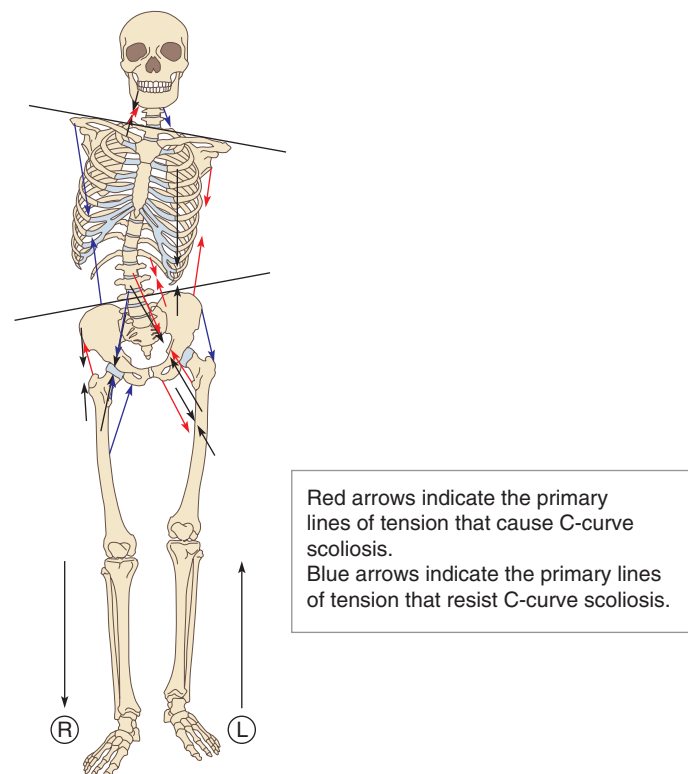
FIGURE 2.7 Example of Pulls of Tension

neck and head posture is very difficult to achieve, if not impossible, for most people. The limited mobility in the joints of the spine does not typically allow for this kind of distorted posture.

FUNCTIONAL C- AND S-CURVE SCOLIOSIS

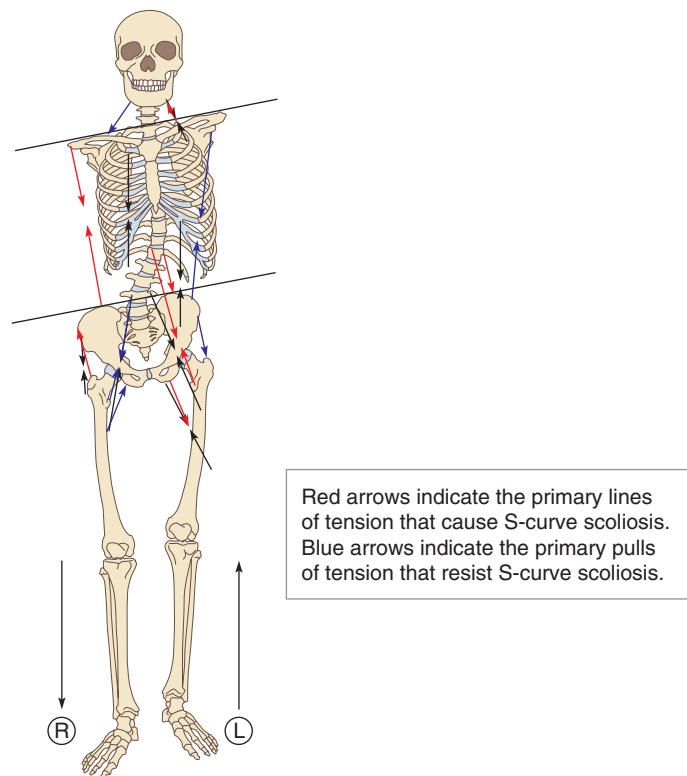
Scoliosis, whether C- or S-curved, can derive from structural or functional causes. In a structural scoliosis the shape of one or more vertebrae is distorted sufficiently to alter the angles between each of the vertebrae. A functional scoliosis derives from one or more muscles overshooting relative to their opposing muscles sufficiently to change the orientation of one vertebra to its neighbor. This is one instance in which x-rays can be helpful to see whether any vertebrae have actually altered their shape. Functional scoliosis is surprisingly easy to straighten once the appropriate primary contractors are determined. Often, cases of scoliosis are functional rather than structural in origin, and the majority of functional scoliosis cases will stem from one side shortening at one or more levels of the body. This functional scoliosis can result in uneven arches, leg-length imbalance, hip asymmetry (pelvic tilting or side swaying), and curvatures and/or rotations at one or more levels of the spine. Scoliosis can exist without leg-length discrepancies or hip asymmetries.

As seen in sagittal distortions, scoliosis clients will most often experience the majority of pain patterns running **unilaterally** and **vertically**, that is, running vertically from one side of the lumbar region to the opposite side of the cervical region because of a compensatory reaction. (See Figures 2.8 and 2.9.)



With C-curve scoliosis, the left hip and the *opposite* right shoulder are elevated.

FIGURE 2.8 **Example of a C-Curve.**



With S-curve scoliosis, the left hip and the same left shoulder are elevated.

FIGURE 2.9 **Example of an S-Curve.**

These postures and relative pulls of tension are *basic models* and should be used to understand the various twists, tilts, and rotations, as well as the compensatory effect of the muscles in trying to maintain an upright vertical posture and in keeping the eyes level (Figure 2.10).

If the neuromuscular system did not have a built-in compensatory mechanism, the body would fall over and end up on all fours or worse. The body compensates to protect the brain and nervous system. The nervous system does not allow slack in the muscular system; therefore, there is a compensatory reaction for every shortening action.

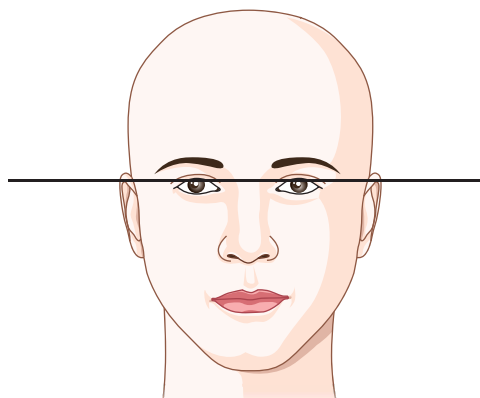


FIGURE 2.10 **Eye Level**

BRIEF SUMMARY

This chapter provides the therapist many of the key elements for determining the most practical, efficient, and correct treatment strategies for restoring muscular balance in each individual. Pertaining to postural balancing, important objectives in restoring a client's pain-free body include:

1. Create symmetry and proper function in the pelvis and lower-limb relationship.
2. Restore the natural spinal curves to the degree possible.
3. Restore a proper and noncombative relationship to gravity.
4. Coach and educate the client in body awareness and self-care techniques.

Clients who receive bodywork sessions and consciously stretch (yoga), along with incorporating retraining exercises, are on the right path to achieving wellness by taking responsibility for their own body.

An experienced massage therapist/bodyworker can be a life-changing coach who assists individuals in achieving a healthier body. The psychological and physical benefits are enormous.

REVIEW QUESTIONS

1. Define *anatomical position*, and explain the three planes of anatomical orientation.

2. Explain structural analysis and postural assessment.

3. Explain postural and functional kinesiology.

4. Define *kinetic chain*.

5. During a client interaction, you should always keep in mind that the strategy, techniques, and intensity of a treatment plan depend on many determining factors. List a number of determining factors in developing a client's therapy approach.

6. The _____ begins as the client comes in the door and moves around, sits, and stands, unaware that he is being observed. It then continues as you observe the client walking down the hallway in front of you or toward the treatment room.

7. During a postural assessment and with the client standing in the central position, what are several questions you should ask the client so that she can consciously experience her body and the way it feels at that moment.

8. On the sagittal plane and frontal plane, the gravitational lines should bisect what bony landmarks?

9. During a table assessment of the transverse plane and with the client in the supine position, what bony landmarks are palpated and compared for levelness?

10. Explain a downward, collapsed “stooped” posture and the chronology of events it starts in the body.

11. Name the primary pulls of tension in a downward, collapsed, “stooped” posture.

12. What posture involves shortening of the hip flexors and the spinal erector spinae muscles producing the appearance of an exaggerated lordosis?

13. As seen in sagittal distortions, scoliosis clients will most often experience the majority of pain patterns running _____ and _____.

14. What pattern of scoliosis is more likely to occur when one hip and the opposite shoulder are elevated?



CHAPTER 3

MUSCLE TENSION AND CAUSES

LEARNING OUTCOMES

After completing this chapter, you will be able to:

- 3.1 Enhance your ability to develop a more effective treatment plan.
- 3.2 Communicate clearly with clients about their conditions.
- 3.3 Develop better insights into where to focus your attention.
- 3.4 Communicate with other professionals about the nature of soft-tissue work.

OVERVIEW

To effectively work with muscle tension, it is helpful to understand what muscle tension is, as well as to identify its causes. Pain and dysfunction are often, but not necessarily, the result of a mild to severe accident or trauma. In some cases, it can move around the body and radiate or refer. Pain and dysfunction are often, but not necessarily, the result of a severe accident or trauma. This chapter helps therapists develop a deeper understanding of the soft tissues and offers insights into the nature of pain and dysfunction. Additionally, it provides more information on how therapists can clearly communicate with and educate clients about pain and dysfunction in the soft tissues.

INTRODUCTION TO MUSCLE TENSION

Muscle tension is a complicated phenomenon involving many things, including actin-myosin ratcheting; overall body tension; tendon, ligament, and bone tautness; nerve excitation; neuromuscular relaxation; tone versus tonus; warm-up; and fitness and health. The only structures in the human body that can generate significant action or movement are the actin and myosin molecules that make up the sarcomeres of muscle cells.

The unique characteristic of a muscle fiber is found in its **actin** and **myosin** structures (Figure 3.1). The actin-myosin pairs are like a ratcheting mechanism by which each sarcomere, each link in the chain of a muscle cell, can pull up within itself to a great percentage. It can also lengthen

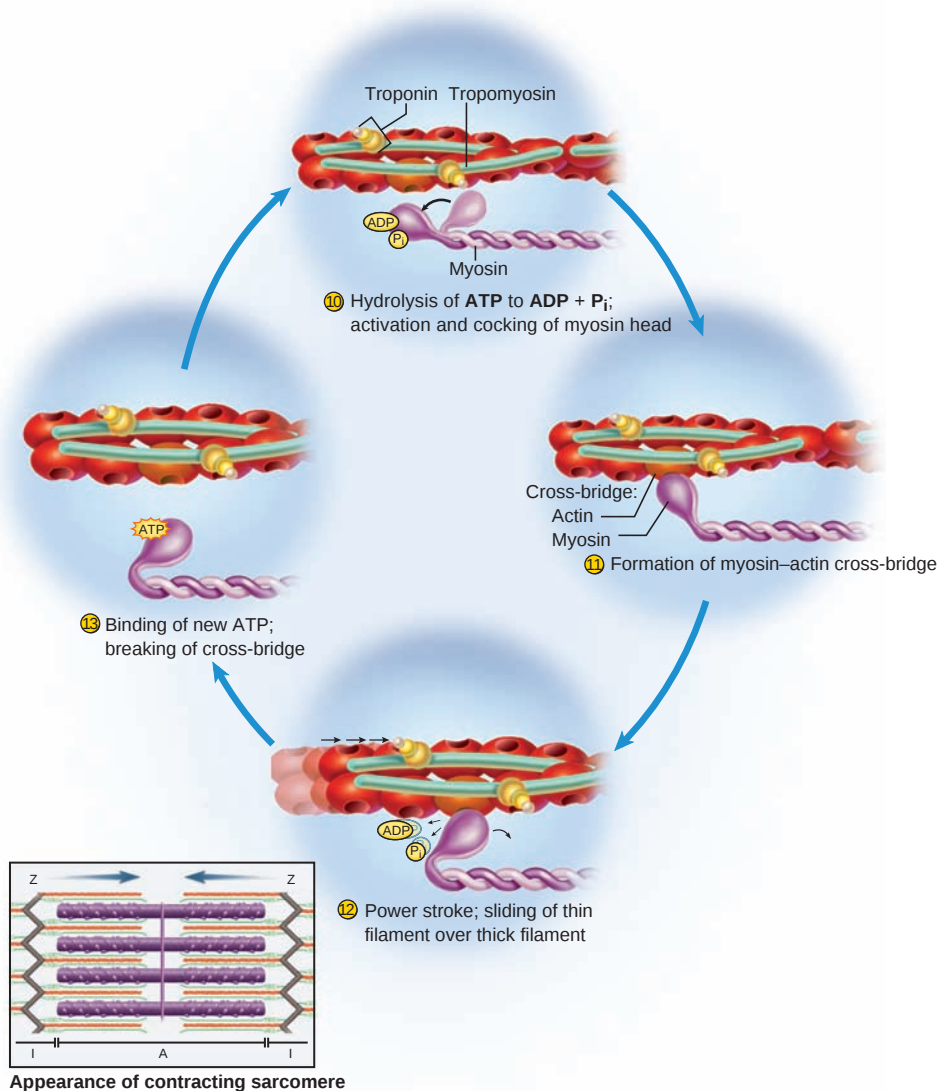


FIGURE 3.1 **Actin-Myosin Action**

to a great percentage on relaxation. Estimates vary as to how much a muscle cell can shorten and lengthen relative to its resting length; however, it is thought that they can shorten as much as 20 to 50 percent of their resting length and lengthen as much as 120 percent of their resting length.

MUSCULAR ACTION AND ACTIN-MYOSIN RATCHETING

A biochemical or electrical charge that activates and transmits through a nerve to a distinct group of muscle fibers causes the ratcheting action of the actin and myosin components of that muscle cell. As the group of fibers is activated, the actin-myosin ratcheting action occurs within the specific muscle cells fed by their respective nerve.

The ratcheting action of the actin and myosin is what generates contraction and shortening and, therefore, tension in the muscle fiber. Stopping the biochemical or electrical input from the nerve to the muscle cell is what stops the actin-myosin action. This is the muscular relaxation process. It is primarily the relaxation of muscle cells and not the restoration of alleged elasticity, of which there is only a limited amount, that allows the muscle fiber to lengthen.

When the biochemical or electrical charge from the **central nervous system (CNS)** persistently remains in an activated state (chronically excited), the muscle remains in the activated (chronically contracted) state. This is **chronic nerve excitation** (Figure 3.2), with necessarily resulting **chronic muscle tension**.

Whether chronic excitation and tension are deemed excessive is determined by the overall situation. Generally, beyond a minimal level of resting tonus, tension that is not directly involved in the execution of a desired or necessary action at a particular moment is excessive. Ideally, however, a muscle should be able to fully relax immediately after it has completed the desired action.

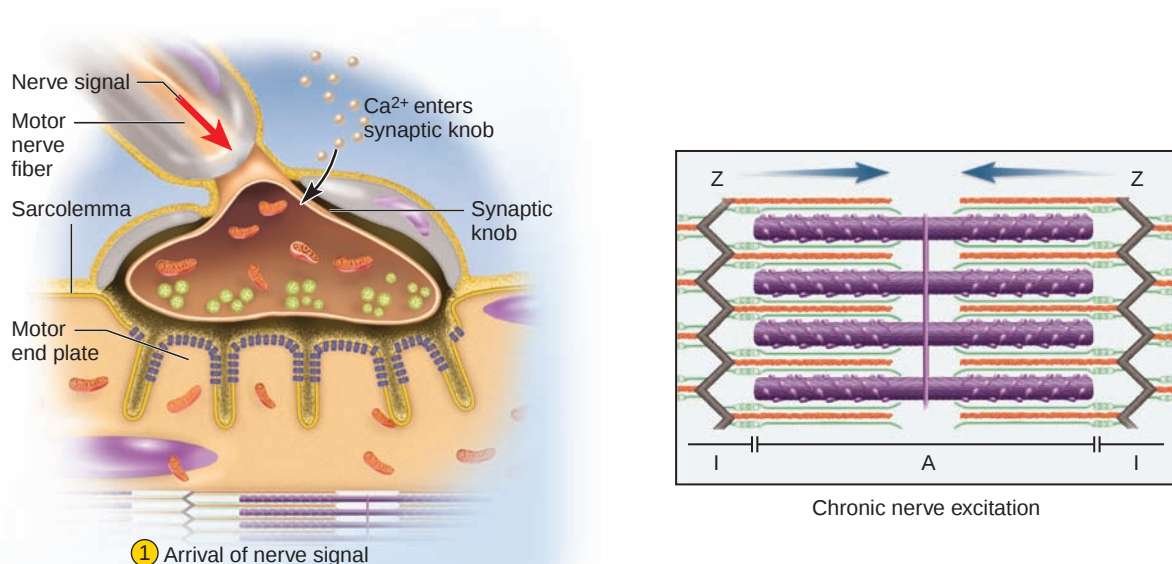


FIGURE 3.2 **Chronic Nerve Excitation**

Effective bodywork involves accessing and deactivating the neurologic phenomena that are excessively and chronically activating the nerves and the actin and myosin cells and are holding the muscle in a contracted state.

GENERAL TENSION

The word *tension* has multiple implications for neuromuscular, myofascial, and musculoskeletal health. Because some words have multiple meanings, therapists must communicate their intended meaning to clients and other practitioners clearly.

TENSION IN TENDONS, LIGAMENTS, AND BONES

In performing structural analysis and postural evaluation, it is important to determine, among many other things, whether a muscular unit is tense because of its own action or because of an action exerted on it by another muscle or outside force. The distinction between internally generated tension and externally generated tautness is critical to understanding myofascial and musculoskeletal dynamics.

In a contractile muscle fiber, tension is the amount of force dynamically generated from within, by the contractive action of the actin and myosin structures within the muscle fibers. A muscular tension force is dynamically generated by its own internal cellular action. This muscular action results in a pulling force on the tendons, located at the ends of the muscle.

The tendon, which does not dynamically generate any active tension of its own, has an increase of static tension or tautness, tension generated by an outside force, that develops as it passively resists the contracting muscle—just like a rope that gets more taut as its ends are pulled. The resistance in fascia and tendon is the result of their having a maximum of only approximately 6 percent elasticity. In terms of elasticity, tendon and fascia are much more like a rope than a rubber band.

For the purposes of structurally analyzing the musculoskeletal system, overall myofascial tension includes tautness of tendons and ligaments and force internally generated by the actin and myosin components of muscle cells.

Psychoemotional implications derived from inner conflicts, fears, and ambitions can generate tension, as well. This kind of tension is best described as nerve activity to the actin and myosin cells that results in active muscular tension.

Increased nerve charge (biochemical or “electrical” tension) causes increased ratcheting activity of the actin and myosin cells (an active tension-generating force). This is the contraction of a muscle that is transferred to the tendons and produces tautness (static tension) in the fascial casings of the muscles, which converge to become the tendons and finally delivers the muscular force to a bone. The result is either a movement or stabilizing force of the bone to which that tendon attaches (Figure 3.3).

For the purposes of clinical massage, structural bodywork, and related soft-tissue therapies, *muscular tension* is the contractive force generated by the actin and myosin cells within the muscles. *Nerve tension* is the heightened state of excitation: the biochemical (sometimes electrical) charge,

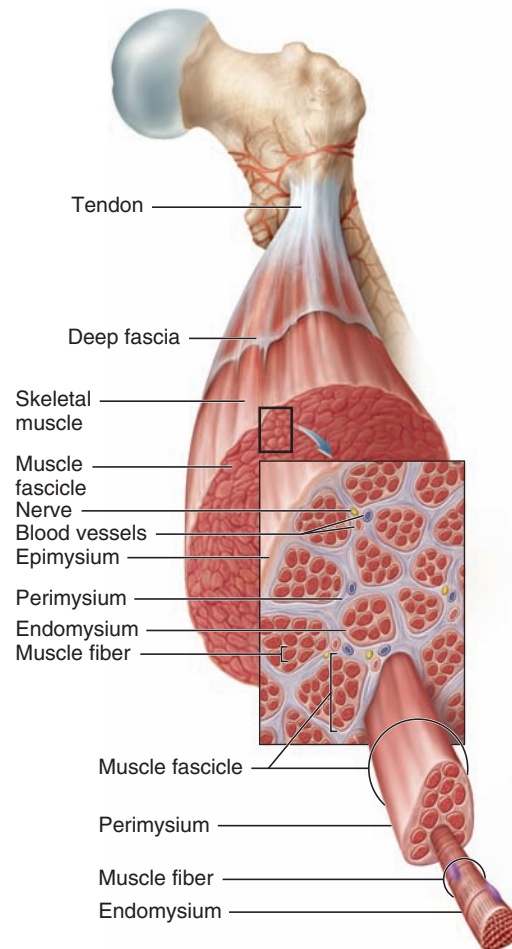


FIGURE 3.3 **Connective Tissue**

traveling through the nerve to deliver sensation or issue motor instructions. Generally, however, it is nerve activity that directly causes muscular contraction.

Tension in a tendon or ligament is different from tension in a nerve or muscle. Like tendons, ligaments cannot generate their own tension. In most cases, a ligament develops tension or tautness as a result of a muscle pulling on a bone; the muscular tension is then transferred to the ligament. The ligament's proper and intended job is to prevent the bone from moving too far. Gravity, too, plays a part in generating tautness. Additional tautness will develop in tendons if, when pulling on a bone, the opposing muscle is also contracting and pulling in the opposite direction. This can add tautness to the involved ligaments. Too much tautness in tendons and ligaments leads to strain or even tearing in those tissues.

A bone cannot by itself create active tension or resistance. A bone resists only when another muscle, gravity, or an external object exerts an opposing force on that bone. Thus, if the muscles on the right side of the neck contract and pull on tendons and the attached bone, no significant tension will develop in the tendon or bone unless the opposing muscles on the left side contract at the same time to some degree. For the purposes of massage and bodywork, tendons, ligaments, and bones are

structurally passive or manifest static tension. In other words, they do not internally generate any overt action or force. Muscles are structurally active, as they can generate their own internal force and action that can be transmitted to other structures, primarily tendons.

tone VERSUS TONUS

A vital distinction in understanding modern musculoskeletal and related problems is the difference between *tone* and *tonus*. *Taber's Cyclopedic Medical Dictionary*, 20th edition, defines **tone**, primarily, as a healthy state of the muscle and, secondarily, as the level of contraction in a muscle, which requires a neuromuscular charge to be achieved. **Tonus**, on the other hand, is primarily defined in *Taber's* as the steady contraction of the muscle, which also requires a neuromuscular charge to be achieved.

This difference between tone and tonus, though superficially subtle, is significant and vital to proper understanding of human health. When people go to a gym, most of their activities are geared toward exercises that repetitively contract muscles to build strength and endurance or enhance cardiovascular function. In doing so, they are constantly activating the actin-myosin units, and therefore the tonus (the biochemical charge), in their neuromuscular system. Most people do little to keep the overall level of tonus down to an appropriate and minimal level. Over time, the increasing levels of tonus become habitual and increasingly difficult to reverse. This results in chronically tight (tonused) muscles.

Many people do little or no stretching or other relaxation techniques to counter the tension accumulation of most exercises. And those who do stretch often push too deep, too fast, and too intensely and hold at this level for too long. In fact, subtle reflexes and subconscious reactions can actually trigger an *increased* level of background neuromuscular firing when people stretch this way, and this leads to even tighter (chronically tense) muscles over time. This is one reason so many exercises that feel good at the time have negative consequences later on. For example, many highly trained and flexible yoga teachers who've been teaching for many years have developed significant chronic tension patterns that often result in aches and pains, limited range of motion (because of pain, not lack of flexibility), and other dysfunctions. The muscles are too tight and, except when in a stretch, too chronically short, even though these folks are otherwise very flexible. Thus, a majority of people are getting tonused (tensed) up, rather than toned up (healthy state) because they are activating more muscle tonus and reducing overall tone. This results in unintentionally building chronic, excess levels of muscle and nerve tension. This is not to say that exercise for strength, endurance, and cardiovascular fitness is not beneficial; however, finding the proper balance between tonus-building and tonus-reducing activities is vital.

NERVES

A muscle contracts when a nerve has activated it. This is the result of a biochemical, sometimes electrical, charge in the relevant nerve that feeds the muscle unit. This charge is called, as we are using the term, *tonus*. Too much tonus for too long manifests in too much muscle tension; this applies pressure and strain to other tissues and structures. Too much tonus can also result in psychological

and emotional stresses that interfere with the client's well-being. Muscle tonus is the amount of this nerve charge coursing through the muscle. The word *tonus* is often used interchangeably with the word *tone*; however, there is an important distinction between the two.

When therapists work on the skin, **fasciae**, and muscles (and sometimes **periosteum**) with manual techniques, they are also stimulating the related embedded sensory nerve endings and pathways. If done properly, the stimulation of the appropriate nerve endings can initiate an inhibitory change in the state of the related motor nerve, reducing its tendency to fire. Less firing down the motor **neuron** means less tonus to the muscle, organs, and glands (Figure 3.4).

This interconnection between the sensory nerves and the inhibitors of motor nerves occurs in the CNS via **interneurons**. Interneurons—tiny neurons that communicate between primary neurons—are part of what gives the nervous system a higher degree of complexity and an appearance of unpredictability.

Reduction of firing, called **inhibition**, in the nerve pathways means fewer signals (less neuromuscular tonus) reach the muscles, resulting in less muscular tension. This inhibitory phenomenon is the essence of neuromuscular relaxation.

Much of massage and bodywork is about effectively inhibiting the nerve charge to the muscles, as well as reducing irritation of sensory nerves embedded in the superficial fascia. This reduction decreases the overall neural irritation of the CNS, and this decrease, in turn, reduces the excitation of neuromuscular motor units.

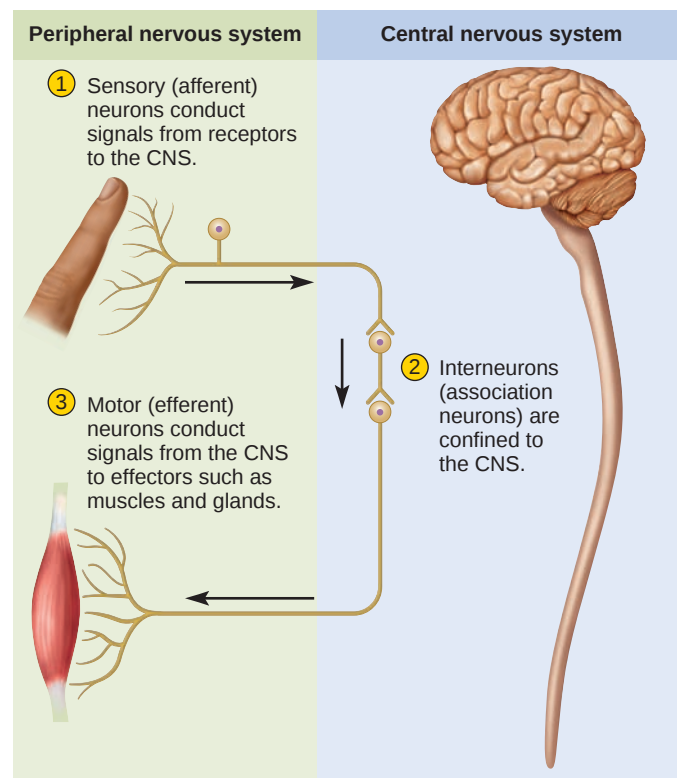


FIGURE 3.4 **Neurons**

RELAXATION: STOPPING TENSION

One objective of massage and bodywork is to relax the psychoneuromuscular units of the body.

True relaxation is the stopping of actin-myosin action, that is, the stopping of “doing” tension. Some such tensions are at the local, reflexive level and respond to purely mechanical or physical techniques. Other tensions are held in place by more complex activities occurring higher in the nervous system and brain. In such cases, to achieve the desired results, the techniques must reach higher into the spinal cord and deeper into the brain. Some of these tensions require that the client consciously let go of, or “turn off,” certain contracted muscles. This is one reason that the **edge technique** was developed; it helps clients stay focused by giving them something specific to stay focused on.

The tiniest contractions of the smallest muscle fibers create actions that are often too small to see or feel. Occasionally, some conditions require letting go of tensions at that level. The question, from a practical point of view, is how deeply and completely a human must relax to achieve and maintain desired levels of health and well-being. The answer is determined by the client’s health care objectives. These objectives should be thoroughly discussed before treatment begins.

WARMING UP: THE PARADOX

Resting tonus is the accumulated level of nerve charge and resulting increased state of contraction (tension) of the neuromuscular unit. Throughout one’s life, this level tends to reset to increasingly higher levels, leading to feelings of tightness and stiffness with aging. Resting tension produces the resistance of muscles to lengthening. Proper stretching reduces excess systemic resting tonus by way of reducing the activity of the psychoneuromuscular system. We are told that before stretching, to be safe, we must “warm up” the tissues. Yet for many people, warming exercises—as well as aggressive stretching—are performed at the strictly physical level, and any loosening is not the result of stopping of complete psychoneuromuscular activity. The muscles and other soft tissues might feel looser from activities that “warm” them up. But warming the muscles through such activity more likely creates physical changes in the local muscular and fascial tissues by increasing the speed at which the local molecules within the tissues are moving. This does not necessarily include a reduction in the biochemical charges in the deeper psychoneuromuscular system. Rather, the client is attempting to coerce the muscle tissues to lengthen, hoping to restore some sort of lost myofascial “elasticity.” However, the percentage of elasticity in a myofascial unit, as reported in the literature, is only 6 to 11 percent, maximum. And most of that elasticity cannot be accessed until the actin-myosin action—a conscious, neuromuscular relaxation—has fully turned off, a condition few people are able to achieve. While certain automatic neuromuscular reflexes can help reduce physical tension levels, the relaxation is often not deep enough to achieve the desired or necessary results. This explains why some people cannot get deeper into a stretch—they are relying on the mechanical, strictly reflexive, approach, rather than the mind-body and edge approach, which engages more of the nervous system and higher levels of the brain, and does not trigger counterproductive

reflexes. With the more mechanical approach, the resting tonus in the muscles, when they cool down, is more likely in the long run to actually be higher, resulting in even tighter muscles. Warming up or stretching this way does not achieve the true degrees of psychoneuromuscular tension reduction necessary to maintain proper tone, a healthy state.

DISTINCTIONS IN RELAXATION

The motor plate is the location where an individual nerve ending merges with its respective group of muscle fibers at the neuromuscular junction. When a neuromuscular unit relaxes, it does so by reducing the charge in the nerve to the motor plate that controls the contractive state of its respective muscle.

It is important, then, to distinguish neuromuscular relaxation from the kind of relaxation that results from warming the local muscle tissues. Later, this book addresses whether it is wise to warm up the tissue before applying hands-on soft-tissue techniques.

FITNESS VERSUS HEALTH

According to “hard-body mythology,” muscles must be hard and tight for a person to be healthy and maintain good posture, definition, and shape. In truth, many people pursuing a “hard body” are accumulating chronic, excess muscle tension causing their muscles to increasingly tighten over the years. Many people who are apparently and superficially fit from “tonusing up” are sacrificing their health, becoming more prone to the many problems arising from chronic, excess muscle and nerve tension.

HOW DOES IT BECOME CHRONIC?

The answer to why neuromuscular tensions become chronic is found in the **law of facilitation**,¹ which states that the more often a nerve fires, the more likely it is to fire again. This is due to a modification of the chemical bath surrounding and within each of the synapses, the switches that turn individual neurons on or off. The changing chemical bath reduces the resistance at the synapse so that it gets easier and easier to transfer a nerve charge from one neuron through the synapse to the next neuron. This is the basis of how the nervous system learns its skills and accumulates its knowledge. Facilitation is also the process by which people accumulate their aches and pains. Bodywork and conscious stretching are ways to defacilitate the involved synapses, making it difficult for the nerve charge to pass from neuron to neuron.

Synapses can become chemically modified to the point that they get stuck in the on position. This prevents the affected muscle or related organ from relaxing.

¹“The Chemical Modification of Individual Synapses,” *Dorland’s The American Illustrated Medical Dictionary*, 21st ed., Saunders; Raymond Nimmo, *The Receptor, Specificity and the Law of Facilitation in the Nervous System*, vol. 2, no. 1.

A synapse can potentially reach, and eventually stay in, a constantly facilitated state in which it cannot reduce its charge; it is always on. Any other neuron, muscle, organ, or gland that is attached to a neuron fed by that synapse will also stay in a chronically excited, or “switched on,” state, which leads to many problems.

One objective of massage and bodywork is to manipulate the tissues to modify the chemical bath at the synapses, making them less prone to firing and turning them off except when they are needed. This process involves applying slow, steady, constant pressure (no rubbing back and forth) on a particular portion of a muscle, well within the client’s edges, for however long it takes to evoke a softening—a relaxation—of the myofascial tissue.

TEMPORAL VERSUS SPATIAL SUMMATION

Summation is the summing—the adding up—of all inputs converging on a particular synapse. As a synapse is exposed to sufficient nerve inputs, the **potential** for firing of the synapse is increased. It is this increase of synaptic potential that increases the ease with which a neuron will fire and contributes to the ability to, for example, remember a fact or improve a physical skill.

This summation can occur gradually, with stimulation ranging from small, nonstressful actions over a period of time (e.g., practicing a musical instrument), or it can occur all at once in a significant traumatic event (e.g., a car accident) as many nerve inputs converge in one moment. (See Figure 3.5.) According to Deane Juhan in *Job’s Body*, some individual synapses receive as many as 10,000 neurons converging from different parts of the body. Yet along with recording pain and

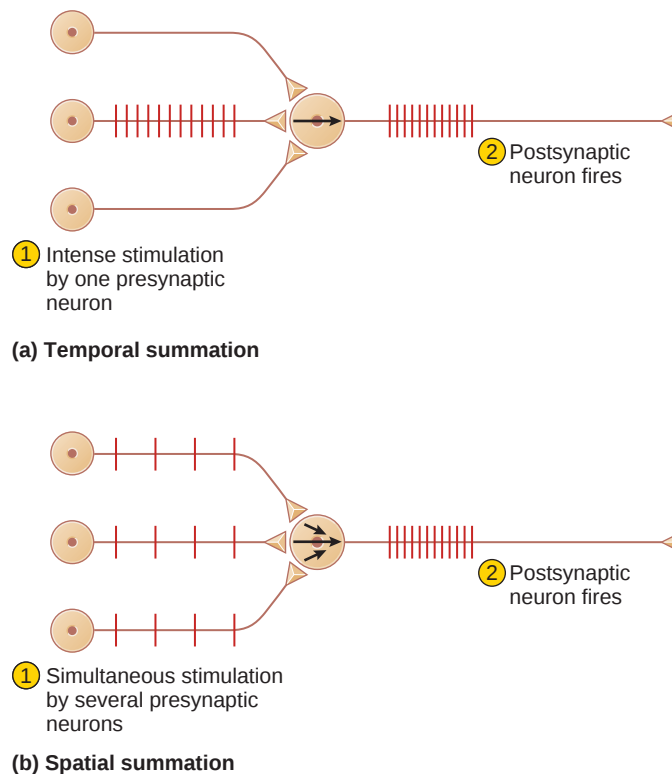


FIGURE 3.5 **Spatial and Temporal Summation**

dysfunction, summation of synaptic potential is also how the mind and body acquire knowledge and learn skills. For example, when an infant hears her name repeated over and over, the recognition of the name is facilitated, or the name is remembered, by modifying certain synapses to record that sound and its associations into the physiology.

TEMPORAL SUMMATION

Temporal summation refers to a synapse being fired many times over and over again, usually over a long period of time with a short duration between each firing. Each time a neuron delivers a nerve charge to the synapse, the chemical bath surrounding and within the synapse is modified to allow the nerve charge to move more easily through the synapse and onto the next neuron.

Repetitive action over time can be very slow and micro-incremental in its accumulation. One example is taking a leisurely walk every day: Every day, the contraction of the muscles and the synapses being engaged in walking become a tiny bit more facilitated. The respective muscles become incrementally more chronically contracted. Over time, that contraction accumulates, until one day, many years into the future, the level of contraction might reach a threshold of chronic, excess contraction. This process is temporal (over-time) summation. Walking feels as if it is loosening the body, and it is. But the background neuromuscular tensions are actually increasing and accumulating, and this leads to chronic, excess muscle and nerve tension.

This tension accumulation can be avoided if the walker engages in effective tonus reduction strategies, such as “mindful” stretching or yoga.

SPATIAL SUMMATION

A multicar, high-speed accident also hyperfacilitates many of one's synapses. In this scenario, many highly stressful and damaging impacts and strains to the body happen in the space of a few seconds. This includes the body's own high-speed, high-intensity internal reactions to the impact and injuries, many of which occur in the form of muscular contractions. These internal reactions are usually of a much higher degree of force than the original impact to which they are reacting. Each of the sensory and motor events in the nervous system has the potential of generating enough stimulation to the involved synapses to excessively and, more or less, permanently facilitate them because they are recorded and embedded in the psychoneuromuscular system; however, the results of such facilitation do not necessarily manifest immediately. It can take hours, days, weeks, months, or even years to fully affect their respective nerves, muscles, fasciae, joints, and organs to the degree necessary to create noticeable pain and/or dysfunction.

HOW DOES IT BECOME EXCESSIVE?

There are many conditions and forces in the body that can facilitate excessive and chronic muscular tension. Many appear so small and benign, however, that they are often not thought to be problematic. For example, walks may not be inherently bad; however, just because one loosens up does not mean the body is relaxing at the deeper levels of the CNS and brain. A number of things can happen, as discussed below.

NEUROMUSCULAR DISCOORDINATION

Muscular tension, in and of itself, is not necessarily a direct cause of pain, nor is bad posture. In fact, there are very few pain-sensitive nerves in the actual muscle fibers. Rather, it is inappropriate pressure on joints, nerves, and related neuromuscular and myofascial structures that causes pain. Muscle tension can cause pain in various circumstances, but tightness itself does not necessarily cause pain. Metabolic changes, such as toxicities and deficiencies in the area, can cause pain as well, but that is outside the scope of this book.

It is important not to assume that pain is always or necessarily caused by “tears” in the tissue. It is often possible to instantly stop even severe muscular pain by applying manual pressure to the area. If a tissue is said to be torn but the pain dissipates instantly on relaxation, it is unlikely that the tissue sustained a tear. This is not to say that torn tissue cannot cause pain. Yet pain, even severe pain, is not necessarily an indicator of tearing or other tissue damage.

When no tissue damage, pressure on joints, or other related factors exist, pain may be caused by an event that creates disharmony—a discord—in the firing of adjacent groups of muscle fibers. When a group of independently firing muscle fibers, a motor unit, falls out of synchronization with an adjacent or nearby group of muscle fibers, each group then sends signals that are different from those of its neighboring fibers. The motor unit is the location where an individual nerve ending merges with its respective group of muscle fibers. A phenomenon similar to the computer term *GIGO* occurs: garbage in, garbage out. This phenomenon is reported by Deane Juhan in *Job's Body*. Each final motor nerve fiber controls only, on average, 10 to 100 microscopic muscle fibers, so each independent unit is extremely small. Thus, it appears that a pain pattern results when the CNS detects conflicting signals coming from neuromuscular units that should be reporting similar information. It is possible that the highly sensitive muscle spindles and Golgi tendon organs within the intrafusal muscle fibers are highly susceptible to this. Muscle spindles measure the distance and speed of lengthening and shortening of groups of muscle fibers (Figure 3.6). Golgi tendon organs measure the degree of force exerted or experienced by the neuromuscular unit (Figure 3.7). Applying appropriate pressure on the specific muscle fibers can bring them back into a normal relationship with their adjacent fibers. Finding them can take time, and working with a client's edges is very important; however, lesions of this type can often be resolved quickly.

REPETITIVE ACTION

Repetitive action in a muscle, even very small actions, which requires firing a nerve over and over again to contract its muscle fibers, breeds chronic accumulations of muscle tonus and therefore muscular tension.

When a body executes an action, it does so by volitionally commanding the **extrafusal** fibers to contract or relax in necessary patterns. The extrafusal (volitional) fibers are directly controlled by conscious functions of the brain. Extrafusal fibers are groups of specialized muscle fibers that exert powerful, volitional force to the bones to achieve intentional external action. They are more numerous in number than intrafusal fibers, and they mostly consist of chains of actin-myosin units.

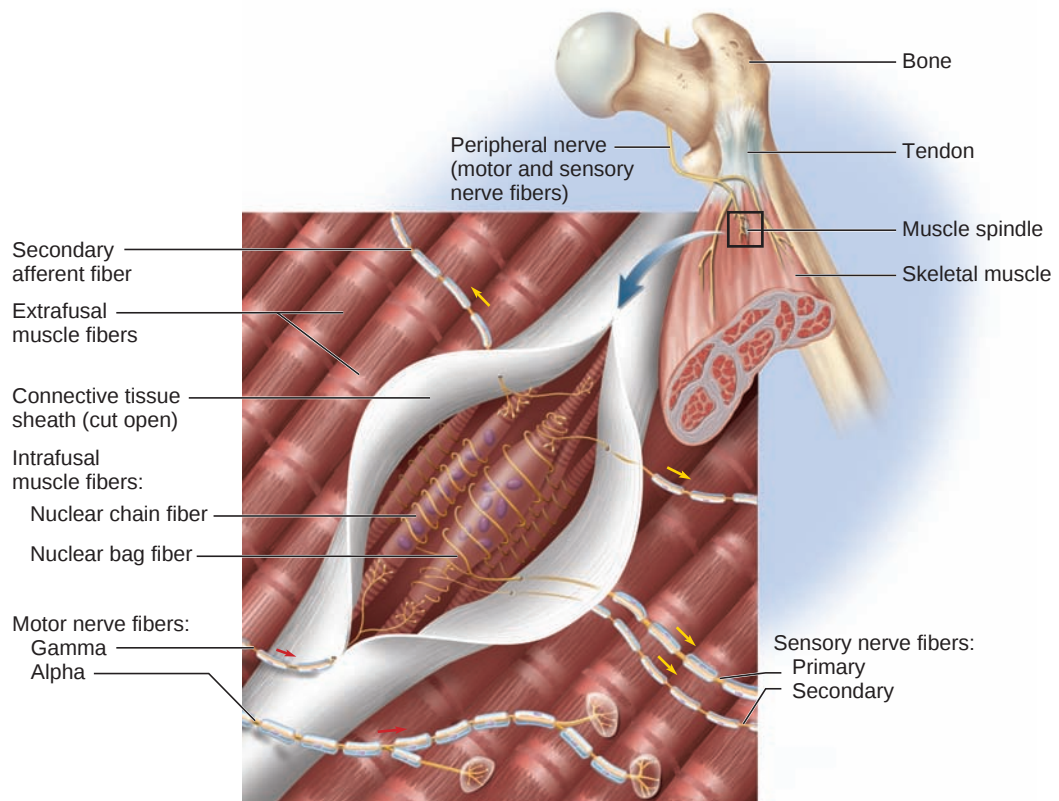


FIGURE 3.6 **Muscle Spindle**

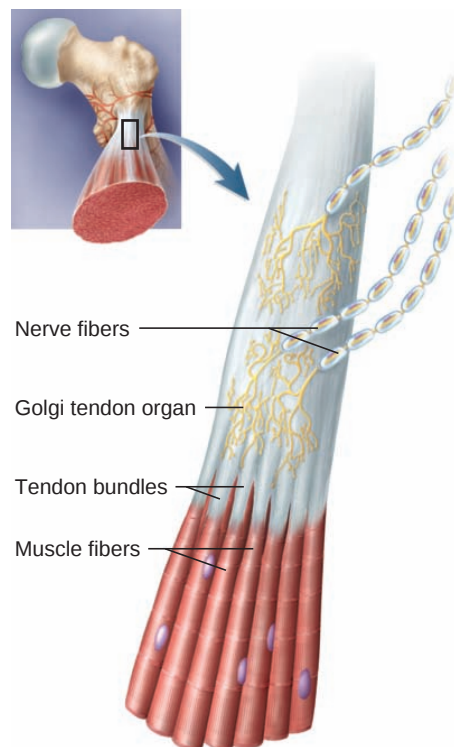


FIGURE 3.7 **A Golgi Tendon Organ**

The **intrafusal** fibers, however, are not directly controlled by the conscious portions of the brain. Their nerve pathways terminate in the brainstem and do not reach the cerebral cortex. Intrafusal fibers are specialized muscle fibers that contain various sensory nerve structures embedded within groups of 10 to 100 extrafusal fibers. Intrafusal fibers monitor the activity of the overall motor unit and manage the background postural and structural relationships. These fibers also contain a relatively small portion of actin-myosin contractile segments.

It is possible for a person to consciously control, that is, contract or relax, the extrafusal fibers; however, people do not typically exert direct control over the intrafusal fibers. While certain individuals, with practice, might develop indirect access to such control, it is not typically available to the average person.

Since it is impossible to directly exert conscious control over the intrafusal fibers, people cannot directly contract or relax them. People can, however, indirectly influence intrafusal function with conscious action.

Each intrafusal fiber contains a much shorter actin-myosin contractile segment at each end, with a sensory component in the middle of the belly. The intrafusal fibers do not exert large amounts of force, yet they can exert enough influence over the extrafusal fibers to hold the body out of proper postural alignment. The intrafusal fibers are, however, subject to the facilitation (learning) process and can become locked in a chronically shortened position.

Due to the law of facilitation, the intrafusal fibers are the elements that learn and subsequently control the postural stabilization and background motion and action habits accumulated over a lifetime. The intrafusal fibers participate in controlling the overall resting length of their respective muscle fiber groups, which include the extrafusal fibers. The relevant synapses are repeatedly stimulated and chemically modified to maintain, or even increase, what they learn via their accumulated experiences. As such habits become chronically facilitated, the client can no longer overpower the shortened muscles without excessive use of other muscles that were never intended to be primary postural stabilizers.

In massage and bodywork, the intrafusal fibers, embedded in and parallel with the extrafusal fibers, are efficiently affected with more subtle touch strategies and techniques than are usually applied in manual therapy. It isn't possible to separate or feel the difference between the intrafusal and extrafusal fibers because they are too closely embedded, are interactive, and are microscopic in size; however, it is possible to treat both the extrafusal and intrafusal fibers simultaneously without losing effectiveness and efficiency. It is important to remember that the intrafusal fibers are where the most sensory nerve endings are located; they are the primary controlling factor in habitual muscle tension and length.

It appears that one reason this phenomenon is not widely recognized is that, for many years, electromyographic studies were conducted with equipment that could measure only the activity of the alpha nerve system, which controls the extrafusal fibers; the studies were not able to measure the activity of the gamma nerve system, which controls the intrafusal fibers. In truth, while an extrafusal fiber group might have been inactive and comparatively relaxed, its corresponding intrafusal fiber could have been very active. As a result, many of the problems that were believed to be caused by neuromuscular weakness and lack of tonus were actually excessively shortened or lengthened—chronically

imbalanced—and exhausted neuromuscular units. Whether overshortened or overlengthened, the intrafusal fibers were very active and contracted and very overworked. So while many clients were working to activate and strengthen what they believed were too weak, low-tone muscles, what they really needed was relaxation, decompression, and balancing of the intrafusal components of their muscles. Because the intrafusal fibers exert overall control over the entire muscle unit, as they normalized, the extrafusal fibers would therefore relax and normalize as well.

DAVIS'S LAW

Davis's law is an old “law” from medical physiology that has fallen into disuse; it is probably better referred to as a *principle*. This principle is currently taught in many neuromuscular therapy courses, and its basic premise is valuable for understanding the dynamic relationships between musculo-skeletal units.

The old law states that when the ends of a muscle move toward each other, the tonus in the muscle goes up. This means, essentially, that nature does not allow a slack muscle to exist in the body; the neuromuscular system always takes up available slack.

Conversely, when the ends of a muscle move away from each other, if all other things are equal, the tonus goes down. Davis's law also includes the phrase “therefore ‘weakening’ the muscle,” implying that the reduction of tonus creates a so-called weakness in the muscle. But this alleged and imagined weakness is in actuality a very appropriate and necessary relaxation of the intrafusal and, consequently, extrafusal fibers. Calling it “weakness” may very well have led to untold numbers of misdiagnoses and mistreatment over the decades. Unfortunately, countless therapy sessions have been spent trying to get people to “strengthen” these so-called weak muscles.

If no overt force is exerted in a muscle, as with lifting a weight or moving an object, then the extrafusal fibers, which are responsible for volitional action and the primary exertion of muscular force, will remain relatively inactive; however, the intrafusal fibers, which control the background postural relationships and stabilizers, must actively contract to shorten in order to maintain proper relationships between each bone and adjacent muscle. Just enough extrafusal fibers will be contracted to facilitate this action. This is one reason people can “feel” as if they are relaxed, yet have very tight muscles.

If the body is unable to take up excess muscular slack, it would be in a state similar to that of a rag doll, unable to react and respond to events in an instant. This ready-to-act aspect of the neuromuscular system is a survival mechanism built into the body by nature. The intrafusals work intimately with the extrafusals; the intrafusals provide just enough influence to maintain the learned background postural and structural relationships.

While the extrafusal fibers in some people might not be very active, the intrafusal fibers can be quite active and influential. Maintaining bad posture, such as sitting in a slouched position for a prolonged period of time, keeps many muscles excessively shortened and their opposing muscles overlenghtened. Davis's law is working the whole time, keeping the tonus in the intrafusal fibers fully active. The intrafusal fibers must continually adjust to the available slack by shortening or lengthening to conform to the body positioning. The more repeatedly this happens, the more conditioned or facilitated the intrafusal fibers become. While there may be no overt movement, the

nerve is continually exciting the intrafusal fibers to hold them in the contracted state, and the law of facilitation says that they are going to eventually stay that way. If this shortening force is continually exerted and becomes habitual, and the intrafusal fibers cannot eventually relax and lengthen to match the changes and new relationships between bones, then many problems can develop over time; moreover, the longer the body goes without reversing the tonus accumulation process, the more active the intrafusal fibers are.

Slouching is one of the many reasons that abdominal muscles can feel weak overall and yet maintain a chronically overshortened state: They maintain a shortened position, and the intrafusal fibers, according to Davis's law, have to shorten to take up the slack. The law of facilitation maintains the increased level of resting tonus in the intrafusal fibers at a virtually permanent or chronic state.

The extrafusal fibers are not activated as much and create a "mushy" feeling. The abdominals then are in a chronically shortened state, and although they feel weak, they are really just too chronically shortened and exhausted to do their job properly. Because of their size, power, and location, they also create problems in other parts of the body.

MUSCLE LOADING

The more weight or resistance a muscle confronts, or the greater the force one wishes to exert, or the greater the pressures exerted on the body, the greater the number of individual groups of muscle fibers within the muscle that are recruited to achieve the necessary contraction and force. The more muscle fibers and nerves that are engaged, the more synapses are involved, all of which can become chronically facilitated via their chemical modification.

The total degree of force, the number of fibers recruited, and the frequency of repetitive action determine how much force is chronically exerted by a muscle on various other structures of the body.

ALL-OR-NONE THEORY OF MUSCULAR CONTRACTION

A motor unit in a muscle consists of a motor endplate—the connection between a controlling nerve fiber and its respective muscle fibers—and a group of three to several hundred or so individual muscle fibers. These groups of fibers are bundles within bigger bundles, which are bundles within the biggest bundle: one whole muscular unit.

The *all-or-none theory* does not apply to the whole muscle and all its fibers simultaneously; rather, it applies to each motor unit of three to several hundred muscle fibers, each group independent of the others. Each motor unit can turn on or off independently from adjacent motor units. When it comes to individual muscle fiber units, the individual unit is either on or off, with no varying degrees of on or off. The degree of force and shortening that a whole muscle generates is the result of how many individual motor units within the muscle are activated at one time.

BASIC NEUROMUSCULAR REFLEXES

The body is constantly readjusting to environmental and internal forces. Maintaining homeostatic, structural balance in the musculoskeletal system is a constant process. Much of that process is accomplished by means of automatic, unconscious reflexes built into the neuromuscular system.

Whether maintaining a stable posture, compensating for imbalances, or acting for protection, these reflexes are sometimes in constant action.

STRETCH REFLEX

The stretch reflex is an isolated, one-muscle phenomenon. Any time a muscle is pulled from the ends, its belly is pressed or struck, or the tendon is stretched, compressed, or hit with any speed or force, the corresponding muscle fibers within that muscle will instantly contract (Figure 3.8). One example is seen in the doctor's patellar tendon reflex test. The patient sits with the legs hanging free, and the doctor taps the tendon of the knee gently. In normal conditions, the quadriceps muscles will contract and extend the knee. This is a simple and necessary protective and stabilizing reflex of the body. Yet the reflexes are continually working throughout the day to stabilize the body against constantly changing forces and events, some of which can be quite subtle while still triggering a reflex action.

WITHDRAWAL REFLEX

The withdrawal reflex can occur in any part of the body and involves a wide range of muscles (Figure 3.9). It is a reaction that occurs in response to various sensations, including visual sensations, that present danger to the system. Rapidly pulling the hand away after touching a hot stove is one example.

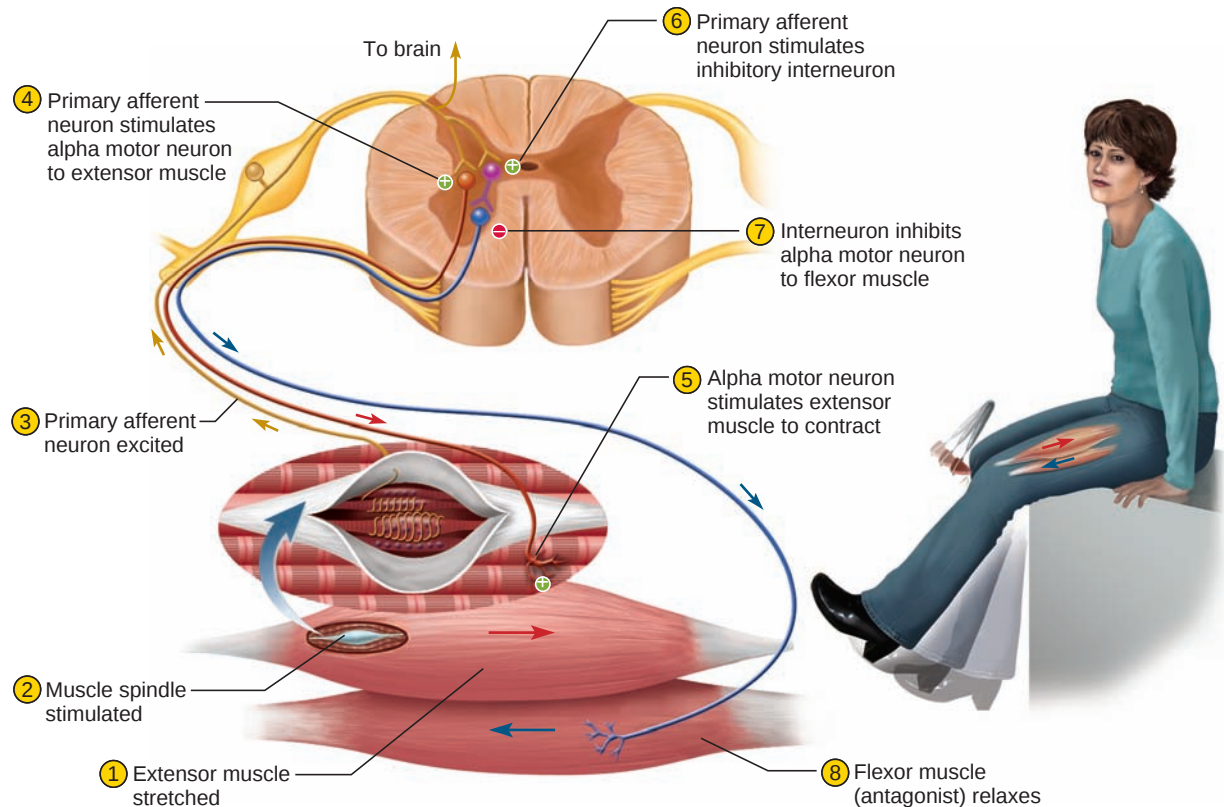
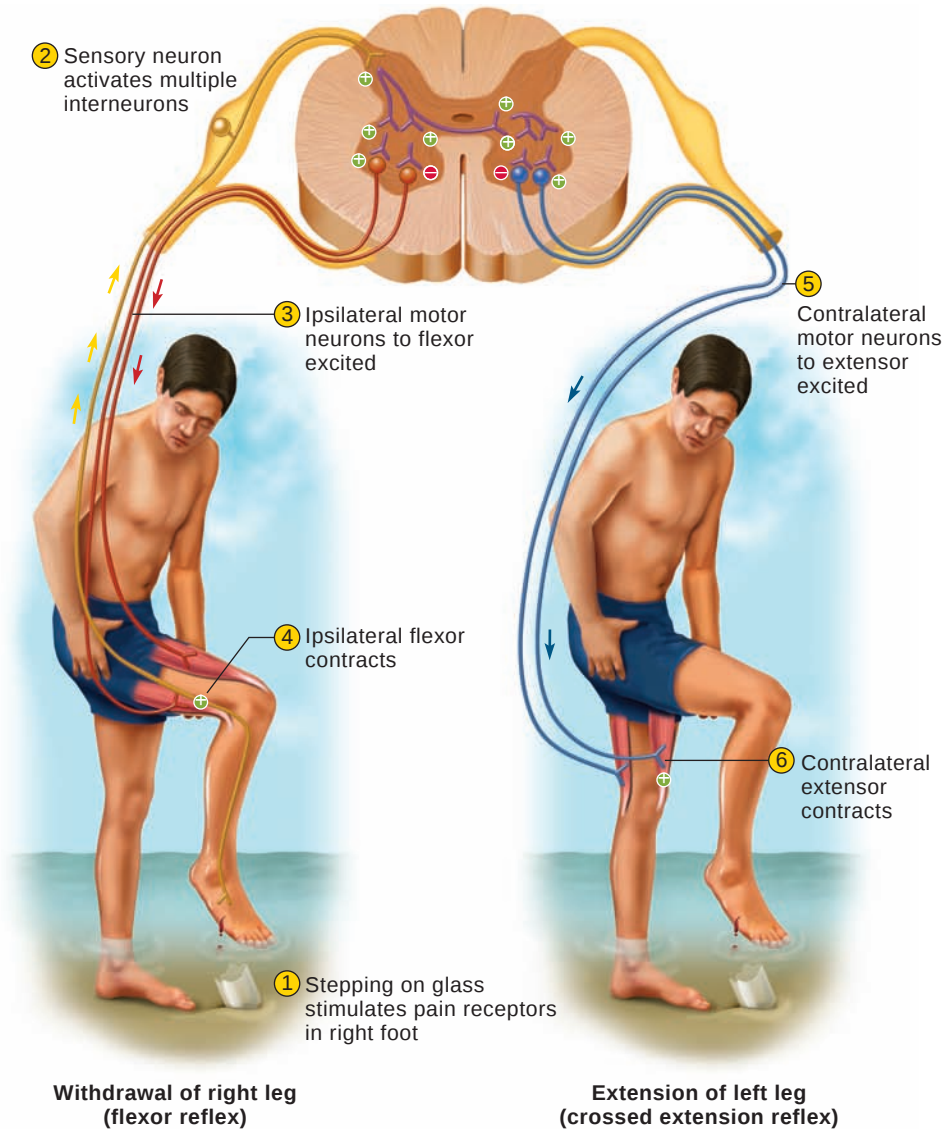


FIGURE 3.8 **Stretch Reflex**

FIGURE 3.9 **Withdrawal Reflex**

PHYSICAL OR MENTAL INVASIVENESS

Even in the absence of pain, any perception by the body and/or mind of invasiveness can cause a tightening of tissues as a protective mechanism. Fear can also trigger this reaction, especially if it triggers the memory of a past traumatic event.

CONDITIONED REFLEXES

Some experiences precondition the nervous system to assume a heightened protective state. This produces negative reactions to sensations, sounds, sights, and movements, even those of small intensity. Reactivity can range from mild to extreme—wherein the muscles go into spasms for hours or days—even after a seemingly minor event.

SUBTLE REFLEXES

Subtle reflexes are not necessarily produced by strong actions. For example, a mildly strong wind can induce the stretch reflexes, which work to stabilize the body by minute contractions and relaxations that adjust to prevent the body from being pushed over. These muscles repeatedly tense and relax as the force of the wind increases, decreases, and changes direction. A body exposed to this kind of force for several hours a day on a daily basis will slowly learn to maintain the tension patterns it uses to stabilize against the wind. Given enough time, no wind needs to blow for the muscles to maintain an increased level of resting tonus. These tensions are stored and contribute to the overall resting tonus of the body.

RESTING TONUS AND RECIPROCAL INHIBITION

Body positions or movements that allow muscles to assume a shortened state for long periods of time cause the involved intrafusal (postural) muscle fibers to increase tonus and become habitually facilitated and shortened. Because of reciprocal inhibition, their opposing muscle fibers tend to lengthen, thereby reducing relative tonus in the lengthening muscle; however, they will usually maintain some degree of tension to take up available slack. This is Davis's law in action. If resting tonus is set very high, it will interfere with the smooth working of reciprocal inhibition.

DISTORTED POSTURE AND MOVEMENT

The longer a distorted posture or movement occurs, the more the involved synapses are chemically modified to keep the intrafusal fibers in a shortened position. This is, again, the law of facilitation in action. When the body maintains a slouched position, for example, the abdominal muscles (rectus abdominus, external and internal obliques) and other lumbar flexors (psoas) are usually in an overshortened position. Depending on how one is sitting, the hamstrings and hip flexors are in overshortened positions too. If the legs are bent significantly at the knees, the hamstrings are in an exaggerated overshortened position. In the absence of activity or movement, the long hours spent in a particular position create chronically overshortened muscles and demonstrate Davis's law and the law of facilitation in action.

Sitting for long periods of time with the gluteals in a lengthened position and the hip flexors overshortened will cause the gluteals to eventually overshorten. When the client eventually stands, the gluteals will have to contract significantly to overpower the shortening of the hip flexors. Otherwise, the overshortened hip flexors could potentially collapse the posture. In this example, the extrafusal fibers of the gluteals will also be strongly recruited because the act of standing is a more volitional action and the muscles need more force to overpower the flexors. The compensatory force of the gluteals pushes the pelvis forward in space, far more than the less powerful hip flexors can oppose. Thus, the hip flexors will not be the predominant force in hip positioning. This is why, with many structural-balancing challenges, the hip flexors are not addressed until later in the session or several sessions into the process.

STRESSORS AND STRESS

While stress is a complex issue and holds different meanings for different people, many stress-related incidents manifest in the body and have a physical component.

According to Hans Selye, the word **stressor** indicates any input that causes a change in the state of the body. Stressors are any physical or mental force, internal or external, that stimulates the physical body to the point of reaction. Some of the resulting stresses are excessive or damaging to the body; others are not. Some are physical; others are mental. Therefore, stress is a reaction to, and the change of state resulting from, a stressor.

PHYSICAL STRESS

Any stressor to the body creates change in the neuromuscular system. For example, any reaction that occurs over and over again within a relatively short period of time will, via the law of facilitation, produce a higher likelihood of recurrence of that reaction. According to the law of generalization, stresses will eventually feed into the **reticular** activation system and cause an increase in neuromuscular tonus throughout the body. The body can develop a particular habitual reaction that is embedded to the point that it recirculates itself—even if the original stimulus for the reaction disappears.

PSYCHOEMOTIONAL STRESS

Many emotional or psychological events also have some physical manifestation. Emotions, by definition, are primarily physical experiences that have mental components to them.

Many emotions have subconscious or conscious feelings attached to them, and some emotions are protective in that they create muscular tensions in the body. They are internal neuromuscular actions that prevent a person from taking action; the prevention is, paradoxically, an action. Repeated often enough, short-term suppression becomes long-term repression. The repetition of these actions is subject to the law of facilitation and can eventually cause other problems down the line.

The sum total of a client's mental and emotional states, including corresponding muscular reactions, constitutes part of a client's psychoneuromuscular expression and state. If modern research is right,² the fascia is also a storehouse of some of this mental and emotional function.

Strong negative feelings that are suppressed may eventually be repressed, and this can lead to dissociation. Dissociation can involve the sensory motor pathways, which serve to help conceal negative feelings by blocking the nerve transmission; thus, dissociation is not necessarily a purely mental phenomenon.

In any kind of therapy, it is very difficult to create lasting change when the client cannot feel. Increased levels of desensitization and/or dissociation can inhibit the degree to which a client can achieve results. Sometimes, psychotherapy is necessary. Hakomi body-centered psychotherapy is just one system that addresses these issues directly; it is an excellent adjunct for the hands-on bodywork therapist.

² Alfred Korzybski, *Science & Sanity*, 4th ed., Institute of General Semantics, 1958. Ida P. Rolf, founder of Rolfing, based much of her early work on her study of Korzybski, who was an engineer, linguist, and philosopher.

Much of the challenge of healing through massage and bodywork therapy involves reversing the dissociation process. The client may have to reclaim specific feelings in order to heal. For some, especially because of desensitization caused by the descending sensory pathways, in conjunction with the law of facilitation, this is the most difficult part of getting well. Fortunately, using the edge technique reduces or eliminates the need to directly reexperience the full extent of associated pain.

TRAUMA

Physically traumatic events can add to overall chronic, excess muscle and nerve tension, since the muscles tend to contract significantly in response to stress.

A victim of trauma is generally unaware of his body's response to trauma. Because of desensitization, sometimes a person needs an outside resource, such as a therapist or physician, to help address the issues. Sometimes, educating a client about the body's response to stress can help initiate the healing process; however, if a massage therapist is dealing with a more complex case, an outside referral may be necessary.

BRIEF SUMMARY

Muscles and their ability to generate tension, as well as their ability to relax instantly, are critical to human function. The words *tension*, *tone*, and *tonus* have many possible meanings; therefore, it is necessary to communicate clearly when discussing these terms with clients and other health care practitioners. It is also important to make the distinction between tone, a healthy state, and tonus, the nerve charge causing its respective muscle to contract.

The frequent use of muscles, even when no injury has occurred, causes their resting tonus to increase over time. There are many possible causes of increased resting tonus, and every event of one's life can potentially contribute to it. Simply repeating the same relatively gentle movement many times can affect the resting tonus of a muscle. The more intense or damaging an event is to the body and/or mind, the more neuromuscular units will become chronically facilitated in a shorter period of time and the higher their resting tonus will become.

Eventually, enough increased resting tonus leads to chronic, excess muscle and nerve tension, potentially leading to a wide range of long-term problems. One primary focus of soft-tissue therapy is to help clients learn how to control, reduce, or eliminate their excess resting tonus.

REVIEW QUESTIONS

1. Name the only structures within the body that can generate significant action or movement and that make up the sarcomeres of muscle cells.

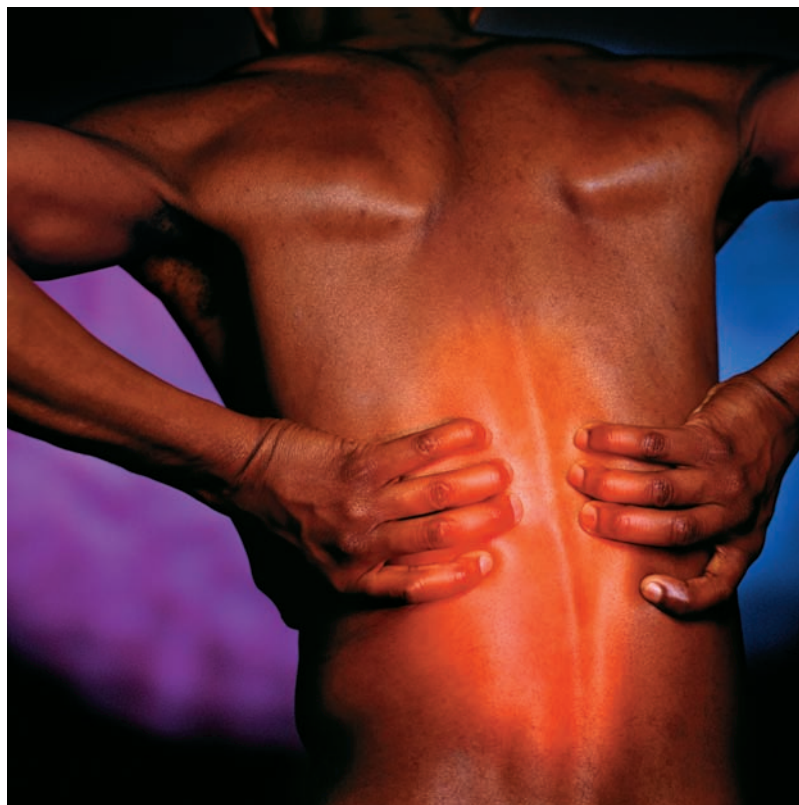
2. Define *static tension*, and explain how it occurs in tendons, ligaments, and bones.

3. Differentiate between the terms *tone* and *tonus*.

4. Explain why “consciously applied” massage and bodywork techniques can facilitate neuromuscular relaxation.

5. The “switches” that turn individual neurons on and off are located within the _____.

6. Name three neuromuscular reflexes, and explain how each works.



CHAPTER 4
SYMPTOMS AND CONDITIONS OF
MUSCLE TENSION

LEARNING OUTCOMES

After completing this chapter, you will be able to:

- 4.1 Understand the mechanism of muscle tension in creating symptoms and pathology.
- 4.2 Identify common complaints associated with muscle tension.
- 4.3 Answer client questions about muscle tension.

OVERVIEW

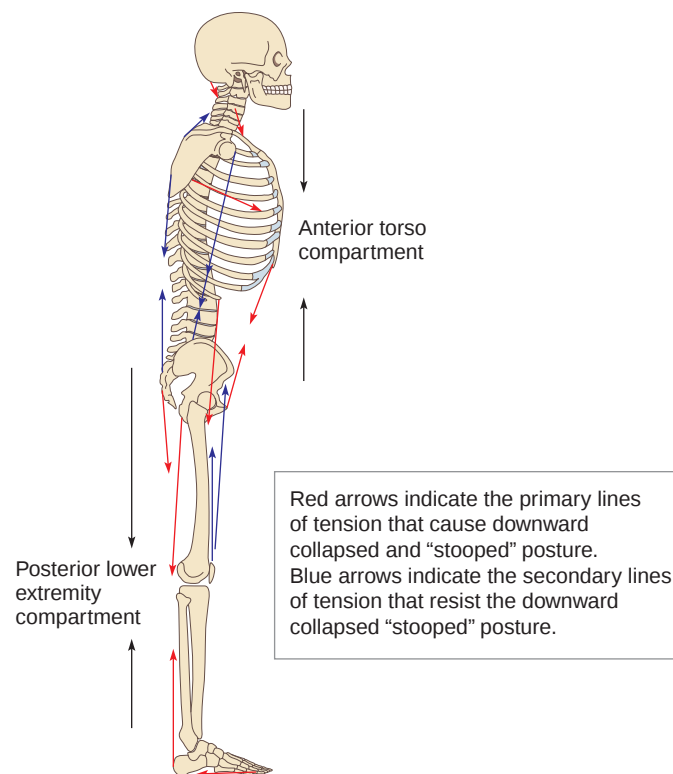
Chronic, excess muscle and nerve tension causes a wide range of symptoms and physical conditions, such as compression of the joints, spinal disks, nerves, and blood vessels; joint and muscle dehydration; pain; and a host of other musculoskeletal problems. While muscle tension is certainly not the only possible cause of these conditions, neuromuscular tension and muscle dysfunction are often dismissed as possible sources of trouble. This chapter discusses how the mechanics of muscle tension can often cause many common disorders. Once massage therapists understand how to work with the tissues properly, they can apply this knowledge to treating other related conditions.

MUSCLE TENSION SYMPTOMS AND CONDITIONS

JOINT COMPRESSION

Many people who report symptoms associated with arthritis, bursitis, and/or general joint-related aches and pains actually suffer from chronic, excess muscle tension of the surrounding area. For example, when the hamstrings become overly shortened from frequent running or from sitting with the legs tucked under a chair for long periods of time, the resting tonus will become chronically elevated, habitually contracted, and overshortened. As the hamstrings overshorten, on rising from the seated position, the quadriceps will begin contracting to stabilize against the shortening hamstrings in a poor attempt to create structural and postural balance while standing or walking (Figure 4.1). If this process did not take place, the client would have to walk around with bent knees and would subsequently collapse.

If the muscles on both sides of any joint are chronically shortening beyond normal functional needs, the space within the joint must endure increasing amounts of internal compression and eventual dehydration. A muscle can also pull on local tissues, primarily the tendon and periosteum, and irritate their embedded sensory nerves; this often produces a pain pattern.



When the hamstrings overshorten and chronically bend the knees, they require counterstabilization from the quadriceps. The quadriceps hold the knees as straight as possible to keep the body from collapsing forward and down.

FIGURE 4.1 **Downward Collapsed and "Stoop" Posture**

GENERAL DEHYDRATION

As a muscle accumulates tension, it can squeeze water out of the muscle belly and lose its diameter and fluid qualities. A decrease in water affects fluid transport, a necessary component of proper metabolism and immune system function. Water is a significant component of the synovial fluid in joints. This fluid holds the joint surfaces away from each other to enable smooth, effortless movement. When too much water is lost, the joint spaces narrow; this can eventually result in osteoarthritis.

Hyaluronic acid is a substance that binds large amounts of water in myofascial structures and contributes to lubricating the fascial and muscle fibers. It is also found in synovial fluid and contributes to shock absorption. As water moves out of the muscle tissue, loss of this acid contributes to **thixotropic** adhesions, or stickiness, in the tissues, thereby preventing them from gliding across each other. A loss of too much of this substance can lead to **cross-linking** (the foundation of scar tissue) of fibers, causing them to lose mobility.

JOINT DEHYDRATION

In joint dehydration, the act of the muscles shortening on both sides of the joint decreases the space and increases the pressure within the synovial space, squeezing out the synovial fluid, which is mostly water. As the joint dehydrates, the lubricant that protects the joint surfaces decreases. Over time, the joint surfaces come into contact with each other, beginning the process of joint surface degeneration. In and of itself, this process does not necessarily cause pain; however, when pain does occur, it is necessary to reduce or eliminate the originating source of the problem, the excess muscular pressure, as soon as possible. Massage and bodywork can help reduce chronic, excess muscle tension. Bodywork rebalances the muscles, takes pressure off the joint and surrounding tissues, and reduces or eliminates the firing in the local sensory nerve endings; when pain is present, it is often reduced or eliminated. Clients can often avoid surgery even if they have a significant loss of range of motion and experience a substantial amount of pain and even when there is significant visible degeneration.

DEHYDRATION, MUSCLE POWER, AND MUSCLE MASS

Some medical research suggests that the action of actin and myosin cells pulling up inside one another displaces water outward toward the walls of the muscle fibers.¹ As this outward pressure increases, the fascial casings take up the slack within the connective tissues, expanding the muscle outward. As it expands, or bulges, the ends of the muscle are pulled toward each other, creating, or at least reinforcing, the overall muscular contraction. It is hypothesized that when this occurs, the amount of water, or the degree of hydration, within the muscle belly directly correlates with how much strength a muscle can deliver to its tendons and bones.

As people age, if they dehydrate, their muscles often appear too thin. The amount of water within the muscle could be a determining factor in the bulk of the muscle; therefore, it might be the loss of water that contributes to thinning muscles.

¹ Mel Robin, *A Physiological Handbook for Teachers of Yogasana*, Fenestra Books, p. 182.

PSEUDO-ARTHRITIS AND JOINT PAIN

Muscular contraction can create irritations that are often diagnosed as arthritis, bursitis, or tendonitis. For example, the anterior surfaces of the iliolumbar ligaments, where they attach to the transverse processes, are pulled by a few of the deepest posterior fibers of the psoas major, as shown in *Sobotta: Atlas of Human Anatomy*. This close proximity to the iliolumbar joints can produce localized pain caused by joint dysfunction and overly contracted muscles pulling on tissues that are close to the joint. If these muscles are not treated, they can contribute to or fully cause the dysfunction of a joint.

Many people who experience pain near various joints of the elbows and/or hands believe they suffer from one of the common joint diseases mentioned above. Yet relaxation of the musculature in the area often substantially reduces or eliminates the pain and discomfort. Often, pain relief is permanent, though it sometimes requires gentle, periodic stretching to be maintained.

COMPRESSION OF SPINAL DISKS

Many types of pain are diagnosed as degenerative spinal disk disease, which includes bulging or thinning disks, **herniation** or rupture, and displaced, slipped, or subluxated disks. While a controversial topic in the medical community, **subluxation** is generally defined in medical texts as a partial or incomplete dislocation or displacement of organs or joint surfaces.² While it is not always clear what causes subluxation, the significant potential effects of excessively contracted muscles on the vertebral column are often overlooked.

For example, in lumbar disk disease, the psoas major is the most direct and powerful muscle that can compress the column of lumbar vertebrae and its spinal disks. Many texts refer to the psoas as a cause of lumbar lordosis, which, it is alleged, involves lumbar extension, or a fanning open and forward of the lumbar vertebrae. If true, this would require a lengthening of the arc or line through the lumbar vertebrae and an overall decompression of the lumbar disks. The psoas muscle would have to lengthen to allow the lumbar vertebrae the room necessary to fan out and forward.

In fact, the psoas major is more likely an overall lumbar *flexor*. The psoas contracts across the vertebrae from the 12th thoracic vertebra downward, crossing nearly parallel to the lumbar vertebrae and compressing the lumbar vertebral disks. Except at the L5-S1 lumbar joint, the psoas not only resists the fanning forward and opening of the lumbar spine but also decreases this action. Thus, the first step toward reversing or stopping the progression of lumbar disk disease is to lengthen the psoas muscle. (See Chapter 7 for a more complete description of the psoas major and its actions.) Any shortening of the abdominal wall would also resist formation of a true lordosis. Yet treating the psoas in isolation and not first checking for overshortening and then, if necessary, relaxing and lengthening the hip extensors and other lumbar flexors, including the entire abdominal wall (rectus abdominis, internal and external obliques and pyramidalis), can lead to either a quick return of psoas-related symptoms or a worsening of the condition. Ultimately, the psoas attempts to stabilize against the pull of these many other muscles, and they must be accounted for before the psoas can fully relax, lengthen, and balance. Additionally, this frees the action of transverse abdominis muscle which is the primary muscle producing an increased lordotic arch and decompression of the lumbar and overall abdominal region.

² See *Taber's Cyclopedic Medical Dictionary*, 20th ed, for both *luxation* and *subluxation*, pp. 1275 and 2097.

FACET JOINT SYNDROME

The facet joints are located on the posterior aspects of the spine. These are the joint surfaces that are the primary intersections between each spinal vertebra; they are bound together by a complex network of ligaments. As the erector spinae become excessively and chronically contracted, they begin to exert various forces that create downward compression of the posterior aspect of the spine, which can jam the facet joints together. These heavily innervated and intricate joints become compressed and lose their ability to move freely. This distorts the overall mobility of the spine and interferes with the multitude of sensory nerve signals generated and sent to the CNS. One can clench a fist tightly for a short time and feel the effect in the joints of the hand. Many people live for years with the facet joints in a compressed and compromised state.

COMPRESSION OR IRRITATION OF NERVES

Countless problems in the human body and mind are the result of impinged, compressed, or otherwise irritated nerves. Many symptoms of dysfunction or pain can be relieved by neuromuscular relaxation of the relevant muscles. Pressure on the nerves in the forearm, arm, shoulder area, chest, or scalenes (neck muscles) can produce irritation and hypertonicity in muscles farther down the limb. Occasionally, referrals to the distal upper limb are even found in the abdominal muscles or elsewhere in the body.

For example, a client suffered from severe pain in the left elbow that interfered with her ability to play the violin. She also suffered from scoliosis, which originated from chronically overshortened muscles in the right hip. The client's first treatment session started with the application of manual pressure to the right gluteus medius and minimus muscles. On the application of pressure, the client reported a direct referral of pain to the left elbow. A dozen subsequent sessions significantly straightened the scoliosis and almost completely reduced the pain in the left elbow.

These common distal body part relationships, as described in the example above, are often perplexing to practitioners; however, the subjective experience of pain is assembled in the brain, not in the periphery of the body. The brain records stimuli, associations, and patterns from all parts of the body, particularly as incidents occur close together in time. This is called an **engram** (not to be confused with the *enneagram*), which can generate a response in one part of the body to a stimulus in a different area—even though there is no nerve that directly connects the two areas.

SCIATICA NERVE IRRITATION

Another example of a cross-body relationship is sciatica. Sciatica is usually referred to in medicine as an entrapment of the sciatic nerve root as it exits the lumbar spine. While this is true in many cases, some clients who suffer from pain believed to be associated with sciatica are actually the unsuspecting victims of pain caused by muscular tensions in the lower back, the gluteal region, the hamstrings, or the calf muscles.

From above the knee, the sciatic nerve travels down and splits off to become the tibial and peroneal nerves. Muscular contraction of or irritation to these nerves below the knee can also trigger pain similar to sciatic or pseudo-sciatic pain.

VAGUS NERVE IRRITATION

Irritation of the vagus nerve (**cranial nerve X**) by indirect muscular pressures in the neck can simultaneously produce headache, dizziness, and nausea. While the vagus is not directly compressed by the neck muscles, irritation to the muscles and nerves nearby can indirectly affect it. For example, the vagus nerve communicates with the trapezius and sternocleidomastoid muscles via the spinal accessory nerve (cranial nerve XI). Indirectly, treatment of the scalenes can reduce or eliminate irritation in the vagus nerve, as well.

COMPRESSION OF BLOOD VESSELS

There are numerous places where blood flow can be directly or indirectly inhibited by muscle tension. For example, certain shoulder girdle muscles cause depression and retraction of the clavicle (collarbone). As the clavicle is chronically held down and back against the 1st rib, it compresses the artery and brachial nerve emerging from the neck. This interference with blood supply can happen in several parts of the body. Cold hands and feet are often restored to normal (sometimes immediately) by reducing muscular tensions that affect the problem area.

IRRITATION OF THE PERIOSTEUM

Some of the most sensitive nerve endings in the body are embedded in the periosteum and their junction with the bones they enwrap. Often, pain is the result of the muscles pulling via the tendons that attach to the **periosteum**. In fact, the periosteum is a continuation of the tendons, just as the tendons are a continuation of the myofascial compartments (deep fascia) that surround the muscle fibers and muscle bellies.

Much of the pain associated with tendonitis is actually stress and strain on the periosteum, which is being pulled away from its attachment on the bone. This irritates or damages the nerves that penetrate from the periosteum into the bone.

PRESSURE ON OTHER MUSCLES

When any muscle begins to shorten, its opposing muscle (or muscles) at some point begins to resist the pulling force by contracting with an opposite force that is at least as much as the pulling force. This is basic **structural homeostasis**. Homeostasis is the relative constancy of the internal environment despite external environmental changes. The body always attempts to keep every force and sensation as close to equilibrium, or balance, as possible, including maintaining upright posture. The righting reflexes are intimately involved with this process, as well.

When a muscle becomes chronically contracted, the opposing muscle must also continuously contract to counteract the force. This results in a constant tug-of-war in which both muscles always tense. This is one way that normally cooperative and balanced muscles become antagonistic, often to the point of combat.

One consequence of this bilateral contraction and tug-of-war is that whatever is caught between the two muscles (or muscle groups) gets compressed and eventually crushed. For example, if the left lateral flexors of the neck chronically shorten and the right lateral flexors chronically contract,

the cervical vertebrae, facet joints, and disks will become compressed, irritated, and compromised until the muscles become exhausted from the excess effort; this is usually mistaken for weakness.

TENDONITIS

The word *tendonitis* literally means **inflammation** of the tendon; however, this can be a misnomer for several reasons.

First, although much of the deterioration and breakdown does occur in the tendon, the cause of the degenerative pressure on the tendon is usually excess contraction generated by its corresponding muscle. Tendons are not designed to carry constant stress and strain. They need time between normal stresses to recover, heal, and regenerate. A chronically contracted muscle keeps a constant strain on its tendon; thus, the tendon never rests and is subject to pain and damage.

Second, according to research published in the *British Medical Journal*, over the last 10 years local biopsies during surgery have often demonstrated that there are no inflammatory cells in the region of the so-called tendonitis. Any inflammation appears to clear up within 3 weeks of the event that caused the actual damage.

Third, much of the pain is often generated by the chronic pulling on and micro-tearing of the periosteum, which is the attachment of the tendon to the bone. Clients often report that the problem feels as if it is “in the bones.” While there is indeed a problem at the surface of the bones, the source of stress is frequently the belly of the muscle. Because of the proportionally high level of sensory nerves in the periosteum and few pain-sensitive nerves within the muscle bellies, this painful sensation distracts attention from the muscle belly.

Periosteal massage can be effective at reducing symptoms or resolving certain issues in the neuromuscular system. Massage of the tendon or periosteum can produce a reflex-induced change in the neuromuscular system, reducing tension in the muscle; this is usually less efficient than direct pressure into the muscle belly. However, if the muscle belly is not directly addressed, the hypertonus muscle fibers will likely continue to create problems in the future.

Because symptomatic pain shows up more often in the tendons and periosteum, the usually causative muscle belly may go unnoticed and untreated. In many cases, focusing on the tendon is counterproductive. In most cases, except for direct injury by external impact, it is direct reduction of the neuromuscular tension that allows the tendon and periosteum to destress, rest, heal, and regenerate.

Fourth, it has been suggested by some medical authorities that the proper term for this syndrome would be *tendinosis* or *tendinopathy*; however, either variation still leaves out the most important factor: the contractile muscle belly that causes many of the problems in the first place.

REPETITIVE STRAIN AND OVERUSE INJURY

Similar to tendonitis, chronic, excess muscle tension puts force, pressure, or restriction on nerves, blood vessels, and other tissues in various parts of the body, often in distant locations. For example, some clients experience pain to the wrist that is referred, for example, from muscles in the abdomen or the opposite hip, as described earlier.

This distant communication appears to be the result of complex relationships facilitated in various parts of the peripheral nervous system that are interconnected via the CNS. For example, a massage therapist who uses sustained, strong pressure with his hands and arms is also contracting his abdominal muscles to stabilize the torso in order to maintain the forward pressure with the hands and arms; therefore, the two actions become interrelated by way of developing an engram, as mentioned earlier.

Although repetitive strain is often referred to as *overuse syndrome*, it is not actual overuse, in the true sense of the word, that causes the problems. The cause is using a neuromusculotendinous unit improperly and without sufficient relaxation between actions. Just as the heart muscle rests between heartbeats, clients must learn to relax completely and let go of tension at every opportunity, including during the course of day-to-day activities. Otherwise, resting tonus slowly climbs over the course of time, ultimately creating pain and dysfunction.

This is one of the benefits of yoga, conscious stretching, tai chi, and other similar disciplines. These practices teach the skills necessary to achieve and maintain deeper relaxation throughout the body. Clients subsequently learn to perform actions and tasks with fewer muscle fibers.

SCOLIOSIS

It is clear through x-ray studies that a vast number of cases of scoliosis (Figure 4.2) present little or no deformity of the vertebral body. In other words, the shape of the bones is relatively normal. It is the positioning of each vertebra relative to the others that produces abnormal spinal curves; therefore, such cases are often the result of neuromuscular and myofascial imbalances that are holding the vertebrae out of alignment. Any kind of trauma, accident, repeated bad posture, and the like, can

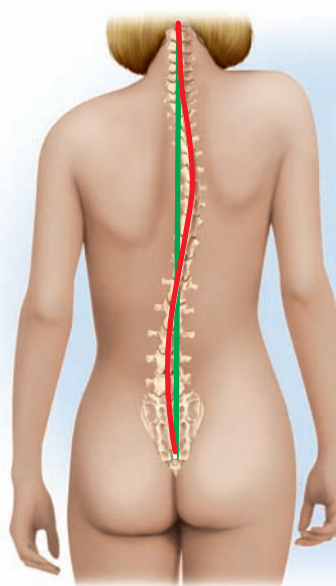


FIGURE 4.2 **Scoliosis**

initiate this type of imbalance. Once an imbalance is in place, it can be difficult to rectify through one's own efforts. Such cases are the result of certain muscles overshortening in relation to their antagonistic muscles.

For example, a lateral curve (concave on the left) forms when the left lumbar erector spinae, quadratus lumborum, and other lumbar portions of the musculature chronically overshorten. Conversely, the spine becomes convex on the right, where the muscles become overlengthened. But because the right-side muscles are preventing the weight of the body from falling to the left, they become more tense and flexed and tend to bulge, as occurs when one flexes the biceps. The bulging muscle on the right (in this example) is usually what gets the most attention and treatment from massage therapists. Yet attempting to relax this muscle often makes the problem worse, as doing so feeds slack to the already overshortened muscle on the left, which becomes even more chronically shortened.

Unfortunately, many approaches assume that the overlengthened muscles on the right are too weak to hold the spine up and must be strengthened to pull the spine straight. Yet doing so only increases compression in the joints of the vertebrae and increases the strain in surrounding muscles; this often compounds the problem. Reliance on reciprocal inhibition to relax and lengthen the muscle on the left side does not take into account the dramatically increased resting tonus, which significantly, if not completely, interferes with the precision and smooth function of that reflex.

In such cases, the vertebrae are not causing the problem; however, the positioning of each vertebra relative to the others shows which muscles have become overshortened. Treatment focuses on the client learning to feel, relax, lengthen, and balance the various muscle pairs. Doing so makes scoliosis, in many cases, surprisingly easy to straighten. Muscle-release techniques, in conjunction with lower-velocity spinal adjustments, are an ideal combination.

FORWARD HEAD-NECK POSTURE

Janet Travell's *Trigger Point Manual* states that anything that levers the lumbar spine posteriorly, flexing or flattening it, causes the cervical spine to also flatten and tilt forward. Flattening of the lumbar spine also tends to collapse the rib cage and cause the base of the neck to tilt farther forward. As the neck and head come forward, they tilt downward. The suboccipital muscles will then shorten to tilt the head back up, bringing the eyes back to level with the horizon. This adds irritation and compression to the muscles below the back of the skull.

The muscles of the abdominal wall, rectus abdominis, and internal and external obliques flex (flatten) the lumbar column. The hip extensors (gluteals and hamstrings) posteriorly tilt the pelvis, and this also flexes or flattens the lumbar spine. Usually, a combination of the shortening of all these muscles is a common culprit for forward head-neck posture.

Some clients experience localized forward head-neck posture by way of overcontracted muscles in neck and shoulder region. Yet so-called tight chest muscles have little to do with causing this postural imbalance.

KYPHOSIS

Shortening the abdominal wall and latissimus dorsi depresses (pulls down on) the thorax (rib cage). As the rib cage descends, the thoracic portion of the spinal column curves forward to form a kyphosis (Figure 4.3), rounding the upper back and midback with the spine concave on the front and convex on the back. This can eventually deteriorate to a dowager's hump.

Paradoxically, clients committed to maintaining “good” posture will, in reaction to a shortening abdominal wall and flexing lumbar and thoracic spine, hypercontract the posterior erector spinae (back) muscles. This action pulls (or attempts to pull) the spine back upright. The aggressive shortening of the upper-back muscles can lead to a flattening or loss of curve in the upper back or even a reverse curve (a thoracic lordosis). This is an example of different clients’ reactions causing two opposite results, even though the originating cause is the same. One client will become excessively slouched; another will stay upright with great, usually subconscious, effort. The latter often suffers more than the former, even though he has maintained the outward appearance of “better” posture. In all likelihood, this client will eventually have thoracic facet syndrome as well.

LORDOSIS

Lordosis (Figure 4.4) is usually defined as a forward curvature of the spine. It is most frequently thought of in relation to the lumbar spine, although it can appear in any of the three spinal curves. It occurs most easily when the pelvis is in an anterior tilt. In the past, many people associated lordosis with back pain; however, a lumbar kyphosis can produce pain at least as frequently.

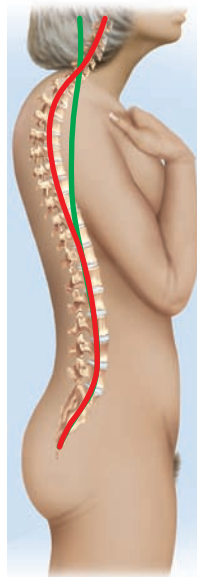
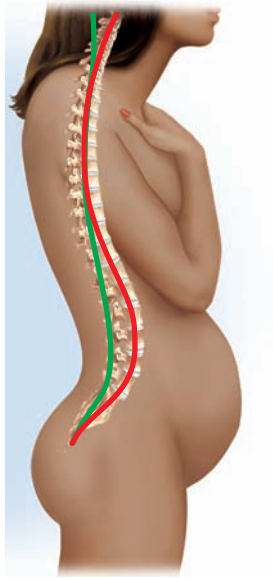


FIGURE 4.3 **Kyphosis**

FIGURE 4.4 **Lordosis**

True excess lordosis is not very common. Many people who appear to have classic lordosis and anterior tilt do not.

BALANCE AND COORDINATION

Resting tonus in a neuromuscular unit is determined by the amount of habitual firing of a nerve pathway originating in the CNS or higher in various levels of the brain. This habitual firing is controlled by the law of facilitation, as discussed earlier.

Speed and coordination are less about training the muscles than about training the nervous system. Proper balance and coordination depend on precise firing from the sensory nerves and precise response of the motor nerves. The muscles must then be free to instantly and precisely respond to the impulses from the nerves. The capacity to generate brute force and maintain endurance is important to a point, yet speed and coordination will usually win out over brute force in most daily activities.

When the resting tonus in a neuromuscular unit—its habitual level of sustained contraction—gets too high, its response time to a signal from the controlling neuron is slower. At first, this delayed response time is unnoticeable. Over the years, however, the resting tonus increases, usually in small increments. The muscle fiber takes longer to respond to the nerve signal, and eventually the response time slows. This is another example of how increased tonus (nerve charge) leads to decreased tone (healthy state) in a muscle. It is also a key component in many of the issues associated with aging. In truth, many things believed to be age-related are really the result of increasing resting tonus and the level of chronic muscular contraction. The most precise and speedy actions are best initiated from a muscle that is relaxed, with minimal resting tonus. A pre-tensed muscle

puts limits on the speed and quality of reaction. Most human beings as they age have increased levels of unnecessarily pre-tensed muscles.

GLUING AND PSEUDO-SCAR TISSUE

The muscles must also not be impinged by the thixotropic effect—the so-called gluing of muscular and myofascial structures—as increasing numbers of muscle fibers get increasingly stuck to each other. This is similar to (though not as extreme as) the chemical process that builds scar tissue. Micro- and macro-scarring of the muscle fibers also slows response time, extensibility, and resilience of the tissues.

Often, massage therapists come into contact with tissues that are hard to the touch; these tissues are often mistaken for scar tissue; however, much, if not most, of this so-called scar tissue is really chronic, hypertense muscle fibers that only feel like scar tissue. True scar tissue cannot relax (in the neuromuscular, actin-myosin sense) because the contractile fiber is no longer present. But some forms of bodywork may help scar tissue soften in a short period of time. If the softening is substantial, the tissue is probably not genuine scar tissue or it is only partially scar tissue. Genuine scar tissue cannot be reversed in this way; however, the side effects of scarring can be significantly reduced by actin-myosin relaxation and softening of the surrounding tissues. From the perspective of the manual bodyworker, increased resting tonus, neuromuscular discoordination, thixotropy, and scarring (and there are others) increase the time it takes for a muscle to respond to signals from the nervous system. This is often mistaken for an injury to or breakdown of the nerves, or something worse. But the first three factors can be reversed by proper manual manipulation.

A fifth factor in response time of the neuromuscular unit for balance and coordination is the compression or irritation of nerve pathways. When irritation levels climb and nerve pathways become chronically stimulated, the neuromuscular unit is constantly activated and is in a heightened state of contraction. This can often be remedied by using effective massage and bodywork to relax the tissues that are impinging or irritating the nerve pathway. Once the pressure on an impinged nerve is relieved, the attached muscles will often instantly relax; therefore, the law of facilitation has not necessarily taken effect. In other words, chronically raised resting tonus has not set in.

FASCIA VERSUS MUSCLE

The capacity of action and movement has often been attributed to the fascial structures of the body—for example, the fasciae of the muscles, which are defined as the compartments that contain and surround each muscle fiber, group of muscle fibers, and entire muscle bellies.

Gray's *Anatomy*, 38th edition, states that the word *fascia* is losing its meaning. While there are a wide variety of tissues that can rightly be called fasciae, they have different characteristics. This variety of tissue is made of the same basic ground substance, but the various tissues are constructed in many different ways with very different capacities.

CAN FASCIA AFFECT BODY POSTURE?

So-called tense fascia has been thought by some to create postural distortion. While it is true that myofascia can indirectly affect movement and posture, it cannot significantly pull the body out of alignment. Additionally, releasing fascia, in and of itself, does not significantly restore postural alignment. It is the contracting or relaxing forces of the muscles that produce posture and movement, and these are the prime sources of restoring balance.

Fascia has no contractile actin-myosin fibers; therefore, it cannot generate force or movement to bring about significant change in posture or action. While stimulation to the piezoelectric aspect of fascia seems capable of creating a kind of “electrical” tension within the fascia tissues, this does not necessarily mean that the tension is the kind of contraction in which the cells or tissues can shorten or lengthen to a great percentage of their resting length, as can actin and myosin muscle cells.

Fasciae can certainly contribute to dysfunction. Thixotropy, the gluing of muscle fibers to each other and to fascial sheaths, can inhibit or alter movement to some degree. The muscles must then compensate for this.

Fascia shrinks slightly when it dehydrates, and thus it can irritate and sometimes compress sensory nerves that send signals to the CNS; this can keep local muscles and organs in a hyperactive state. Softening the fascia can reduce or eliminate this irritation, thereby allowing relaxation of the neuromuscular system. Remember, however, that the softening is not an actin-myosin relaxation.

In *Job’s Body*, Juhan points out that if an elderly person with severe postural distortion undergoes anesthesia, most or all of the person’s postural distortions and rigidity will go away while under anesthetic influence and she will have tremendous range of motion. When she recovers, the distortions and stiffness will return. As another example, the joints of a strong athlete, when moved while under anesthesia, can dislocate if he is moved without care. The ligaments are not enough to hold the joints together. Without the resting tonus from the neuromuscular system, there is very little to hold the body together in either of these examples.

Anesthesia inhibits the nervous system, both the incoming sensory flow to and the outgoing motor flow from the muscles. Since fascia has no motor innervation, it could not respond to the anesthesia to the degree necessary to produce the mentioned effects. This is further evidence that the connective tissues of the body, the fasciae, cannot significantly hold the body in any kind of postural or structural position. It is also unlikely that the connective tissues are a direct factor in treating postural imbalances or structural dysfunction. As described above, there can be some or many indirect or secondary effects, but they are not the primary sources of postural imbalance.

One group of researchers in England reported that they had found a contractile capacity of fascia. But on further examination, the researchers note that this capacity is found only in sites of tissue injury in which stray muscle fibers (with actin-myosin, contractile units) have somehow grown in the tissue while repairing local tissue damage. Thus, it is stray actin and myosin muscle cells—not fascial tissues—that contract.³

³ See www.fasciaresearch.com.

BRIEF SUMMARY

The muscles, by way of chronic, excess muscle and nerve tension, can cause a wide range of symptoms, syndromes, and disease. Many of the symptoms and syndromes caused by muscle tension are mistakenly thought to be caused by other factors. Yet continual contraction of muscles exerts various pressures on tendons, ligaments, fascial sheaths, joints, bones, nerves, blood vessels, and so on. This pressure irritates tissues or interferes with their proper function. Eventually, if the muscle tension is not sufficiently relaxed, the affected tissues can suffer total breakdown. When indicated, evaluation of chronic, excess muscle tension and treatment via massage and bodywork constitute one of the least invasive modalities—and the results are often incredible.

REVIEW QUESTIONS

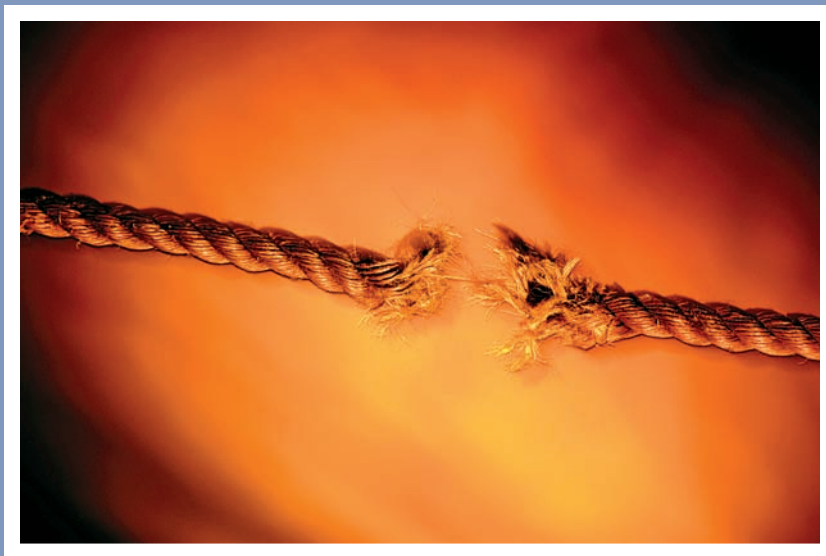
1. Compare subluxation, facet syndrome, joint compression, and degenerative disk disease.

2. Why is tendonitis probably a largely mistaken term?

3. What is the primary cause of forward neck and head posture?

4. What is thixotropy?

5. What is the primary source of postural distortion?



CHAPTER 5
PRINCIPLES OF REVERSING MUSCLE
TENSION

LEARNING OUTCOMES

After completing this chapter, you will be able to:

- 5.1 Understand the mechanisms of the nervous system in tension release.
- 5.2 Distinguish between modes of tension release.
- 5.3 Understand why some clients react differently to treatment than others do.
- 5.4 Apply basic principles of releasing tension.
- 5.5 Explain why “no pain” means “more gain.”
- 5.6 Activate the intrinsic healing mechanisms of the body.
- 5.7 Identify the levels of sensation and know how to work with them.

OVERVIEW

This chapter describes some of the physical and mental obstacles relative to releasing muscle tension. It also provides techniques for working with a client's myofascial tissues and more fully engaging the client in the therapeutic process, and it explains the reasons why this is important. Of great importance is the principle that determines the parameters of how deep to work, as is engaging clients in helping determine where they are on a spectrum of sensation. In many cases, using the no-pain, more gain approach achieves far better results than having the client tolerate negative sensations or pain. Being prepared for the possible forms of negative reaction in the client's body helps the therapist preempt such events.

CORE PRINCIPLES OF REVERSING MUSCLE TENSION

The concept of reversing muscle tension seems simple: Apply pressure to the targeted myofascial tissues until they relax and lengthen. In fact, effective bodywork can often be performed with little knowledge of the body's complexities; however, pain often occurs away from the area of the body where it originates or is felt. In such cases, it is necessary to understand the core principles of finding the causes of and then releasing the muscle tension.

While encouraging a muscle to relax is important, muscles treated too aggressively often do not respond well. At best, they may relax temporarily, only to tighten back up again within minutes, hours, or days. Intrusive treatment potentially triggers neuromuscular reactions that can subconsciously **dissociate** parts of the system, making full normalization and integration difficult. This is the brain's attempt to avoid feeling various physical sensations. According to *Stedman's Medical Dictionary*, 28th edition, *dissociation* means "a separation or dissolution of relations; an unconscious separation of a group of mental processes from the rest, resulting in an independent functioning of these processes and a loss of the usual associations." Dissociative reaction is a sudden, temporary alteration in the normal functions of consciousness, identity, or motor behavior (*Taber's Cyclopedic Medical Dictionary*, 20th edition).

Properly bringing about neuromuscular change within the CNS and the deepest levels of the brain leads to an integrated, long-lasting result. It is necessary, however, for the client to remain open to, or at least neutral about, the sensations she is experiencing. The more pleasurable the experience, the more likely the client is to relax, and this will allow positive changes to occur within the neuromuscular and myofascial systems. When a client resists, results are often limited—sometimes substantially. Working with the edge technique is not about how much pain or pressure a client can tolerate. The very act of toleration, even with good intentions, can produce more dissociation and neuromuscular discord. A client who tolerates treatment is beyond the appropriate limits of the optimal edge and thus limits to some degree how deep any changes can go into the CNS and brain. Additionally, certain functions of the nervous system and brain could have desensitized the client in the past or even while in the midst of treatment. While a local positive change to the tissue might occur, long-term neuromuscular integration most likely will not.

BASIC NEUROMUSCULAR REACTIONS

The following factors explain why too much pressure or intensity during treatment can be counterproductive in the long run.

Stretch Reflex

Any time a muscle is pulled from the ends, the muscle belly is pressed or struck, or the tendon is compressed or hit with sufficient speed or force, the corresponding muscle fibers within that muscle will contract. Therefore, when a soft-tissue technique is applied too fast or too deep, stretch reflexes will be triggered and the muscles either will not relax or will tighten. The stretch reflex can affect any muscle in the body.

Withdrawal Reflex

The withdrawal reflex occurs in response to myriad sensations that present danger to the system, and it involves a wider range of muscles in different parts of the body. If the client experiences or perceives potential discomfort, danger, or damage, he may instinctively attempt to withdraw from the sensation. The withdrawal reflex activates by contracting muscles and can affect any muscle in the body.

Recoil from Physical or Mental Invasiveness

Even when no pain is involved, any perception by the body and/or mind of invasiveness can cause a contraction of the actin-myosin units as a protective mechanism. Fear can trigger this reaction, especially if it involves the memory of a fearful or traumatic past event.

Conditioned Reflexes

Sometimes, traumatic past experiences precondition the nervous system to a heightened protective state. This may cause a person to react negatively to sensations, sounds, sights, and movements, even those of small intensity. This type of reflex can range from mild reactivity to intense, prolonged muscle spasms. For example, a person who has experienced a severe car accident may overreact to little events while driving a car.

Subtle Reactions to the Reflexes

Some reflexes and reactions are subtle and often go unnoticed. For example, a therapist may apply gentle pressure to a client's left hamstring and visually observe the client's right hamstring contract slightly; however, unless the contraction is observed, neither the therapist nor the client will notice it. Yet the contraction, no matter how subtle, is a sign that the therapist is going over the client's limits. Sometimes eliciting a reflex response is necessary to effect short-term relief from pain or dysfunction. For example, a therapist treating an athlete during an event, with only a few minutes available to relax a muscle spasm, may not have a choice. Generally, however, it is not necessary to go above a client's limits.

In bodywork, pushing the tissue too fast and/or too deep triggers these types of reflexes or reactions. The more traumatized or stressed a client is, the more likely that the reflex has been set to a higher level of reactivity. Many therapists do not realize that while they are attempting to release tension by pressing, stretching, or exercising a muscle, they are often retriggering a neuromuscular or psychoneuromuscular memory that reduces, inhibits, or defeats the work. The greater the degree of apprehension the client experiences, the greater the background tension and compartmentalization (also known as *dissociation*) and desensitization. Because some reflexes are often too subtle for the client to notice, it is up to the therapist to watch for signs of resistance in other parts of the body.

The best approach is to start by treating the most superficial layers to achieve some relaxation; then continue slightly deeper into the next layer until releasing the next level of tension. This process continues until enough release has been achieved for the session. When a client is highly traumatized, it is necessary to work in very small, incremental levels of pressure. Sometimes, only a slight change in pressure can trigger an extremely sensitive neuromuscular unit that provokes an

instant jolt of pain. Sometimes, a client's primary problems will manifest in a superficial level of tissue, and once the tissue is released, the rest of the myofascial unit might need only some general work, which can be accomplished quickly. Other times, the problems will be in deeper layers and take a lot of time. Obviously, each client must be treated based on her unique condition. Ultimately, communicating with the client is the most important element of the therapeutic process.

SLOW, STEADY PRESSURE

When a client presents with generalized neuromuscular tension, it is important to treat the muscle as a whole. Large surface areas can be treated at one time, such as using the forearm (or feet) to work the hamstring muscle. The more specific the injury, however, the more specific the advances into the tissues must be. The precision of a fingertip might be necessary in many cases.

First, note that each group of ten to a hundred or so (estimates tend to vary) muscle fibers (controlled by one motor nerve) can be damaged or dysfunctional at the micro level. Many chronic injuries of muscle tissue start with a few microscopic muscle fibers falling out of synchronization or sustaining a micro-tear. Although each group of 10 to 100 muscle cells acts independently, each also works in coordination with its neighboring groups of fibers. As adjacent fibers attempt to compensate for this micro-dysfunction, more muscle cells get tensed and/or dysfunctional. This can progress for a long time, even years, before the client suspects there is a problem.

Specific fingertip pressure, or a massage tool with a narrow tip, can help the therapist find the exact cords or wires of contracted muscle fibers, which can be hard to detect through generalized touch. Finding and exerting gentle pressure on these isolated muscle units and allowing them time to relax will give the longest-lasting results; however, applying pressure that is too deep and/or too fast for too long is counterproductive. Applying pressure for a long time can be very effective but only if the pressure applied is not too deep or too fast.

Ideally, each muscle fiber group should be treated independently on the basis of its specific condition. For the best results, the individual groups of muscle fibers must be normalized and brought into balance and coordination with their neighboring fibers. The more traumatized the specific muscle fibers, the more the therapist should move in the direction of minute, incremental specificity.

For example, it is not uncommon for a therapist to discover—sometimes by accident—a painful, reactive spot near the area that she has been working on for an extended period of time that suddenly sends intense, overwhelming nerve signals, and often pain, all over the client's body. And just as quickly as this occurs, it may stop once the therapist moves slightly off that area. In fact, the area can be so small and hidden that it may take a lot of searching to find the same spot again. Regardless, this group of stressed fibers must be addressed independently before working with the muscles as a whole, primarily because the irritation will keep the CNS in a constant state of overactivation and subsequently contribute to generalized hypertonicity in the nervous system, muscles, and organs. These seemingly minor reactive locations on the body are often overlooked in the treatment room.

The following criteria should be used to evaluate the tissues:

1. Is there too much pain?
2. Are the tissues too hard to the touch?
3. Are specific micro-fibers of a muscle painful or tense? (Do they feel wirelike?)

4. Is a particular layer of myofascia different from its neighbors?
5. Is the client experiencing radiation or referral pain?
6. Is the client desensitized? (Does the client feel numb or feel nothing at all?)

Going slow allows the therapist to find the affected tissues and account for the problems they present. Ultimately, it can take a substantial amount of time to find the client's hidden pain points or triggers because many clients are unaware that the painful area exists. Because of neuromuscular desensitization, the client feels pain only when the area is touched. As always, the more feedback a client provides to the therapist regarding the sensations he or she feels, the better the therapist can develop strategies about where and how to work.

LOCALIZED, RADIATION, OR REFERRAL PAIN

When a therapist applies pressure to an area, clients may experience localized sensations or sensations that radiate or refer. *Localized sensations* occur directly under the pressure of the therapist's hand, fingers, or elbow. *Radiation sensation* travels in one or more directions away from the place where pressure is applied. *Referral sensations* manifest in a part of the body other than that where the pressure is applied; they are also called *trigger points*.

Dr. Janet Travell defines a trigger point as "a hyperirritable spot in a skeletal muscle that is associated with a hypersensitive palpable nodule in a taut band. The spot is painful on compression and can give rise to characteristic referred pain, referred tenderness, motor dysfunction, and autonomic phenomena." Travell describes a trigger point referral as "pain that arises in a trigger point, that is felt at a distance, often entirely remote from its source. The pattern of referred pain is reproducibly related to its site of origin."

Some therapeutic approaches, such as neuromuscular therapy (NMT), focus solely on finding and treating trigger points. While NMT can be very effective for many clients and issues, it is best for the therapist to determine whether a problem is localized or is the result of another source.

MECHANISMS OF TENSION RELEASE

The first principle in understanding the mechanisms of tension release is that no therapist ever relaxes a muscle in another human being: Only the client can relax his or her own muscles. Instead, a therapist gives clients the opportunity to discover ways to relax, preferably at a conscious level, and stimulates the nerve endings in the client's body in ways that will encourage the client's nervous system to engage in neuromuscular relaxation, often at subconscious or unconscious levels; however, subconscious relaxation is more effective and efficient when the client is paying attention to the overall process. Additionally, the client will learn to relax his own tensions without outside assistance.

VOLITIONAL RELEASE

Many actions, including those related to muscular contractions, are generated *volitionally*, meaning that a person has willfully intended to cause the action. Some volitional tensions become habitual over time and go unnoticed by the client at the conscious level. One example of a volitional release is clenching the fist, which requires that muscles contract. The act of stopping the

fist clenching is also a volitional or intentional release of tension—a stopping of the tension at the fully conscious level.

Volitional tension is generated in part by the cerebral cortex—the part of the brain that allows for creative, intentional action. Many people experience tension induced by volitional processes but maintained by unconscious processes. For example, most people are not fully conscious of every action they perform while driving a car. Yet all people who drive consciously willed themselves to learn how and, at one time, had to be fully conscious of each action that was necessary to pilot the vehicle. Over time, the subconscious or unconscious processes took over the job, and it was no longer necessary to think about each and every step in the driving process. Sometimes an emotional reaction to a person and/or event can volitionally tense the muscles, but this often goes unnoticed at the conscious level. Many tensions, however, can be released when a person merely becomes aware of them.

In manual bodywork, the pressure of the therapist's hands “reminds” a client that she has volitional tension accumulation or muscular contraction. Sometimes slight pressure triggers a spontaneous release of tension; other times, the process requires more in-depth bodywork. For the client to fully benefit from treatment and release muscular tension, she must first focus conscious awareness on the sensations associated with myofascial tension to stop them and ultimately release the body's tension. This is called *volitional release* or *volitional awareness*. If the client is not able to produce the needed action or relaxation, the therapist can work with the client to help facilitate the necessary response; however, the client's results will be best when she fully focuses her attention on healing.

REFLEXIVE RELEASE

The body contains many nerves and muscles that perform many automatic functions without having to communicate to higher levels of the central nervous system. Many of these purely automatic reflex arcs are “hardwired” and are generally out of conscious control except in people who have trained themselves extensively in mind-body integration. Other responses that appear to be, or feel as if they are, purely automatic have been learned and facilitated throughout life by the selection and modification of synapses, as discussed earlier.

Many neuromuscular problems (such as trigger points) are confined strictly to these reflex arcs and can be modified and/or eliminated by purely physical interventions without engaging the conscious participation of the client's mind. When a therapist uses purely physical means to release neuromuscular tensions, he is engaging in *reflexive release* processes. Often, NMT and myofascial therapy can achieve excellent results by engaging the reflexive release processes; however, even when tension is reflexive, the act of simply paying attention can have a positive effect on the automated responses of the neuromuscular system. Human beings are equipped with alpha and gamma nerve systems. The alpha system connects directly to the cerebral cortex, which is the conscious part of the mind. The gamma system connects to the midbrain and does not reach the cerebrum. Yet these two systems communicate and interact extensively.

Consider, for example, a person who habitually, unconsciously holds the shoulders up; this is the gamma system at work. However, when the same person is made aware of the behavior, she is likely to consciously correct the problem and drop the shoulders; this is the work of the alpha system. But as soon as the conscious (alpha) mind shifts awareness away from the shoulders, the gamma system

takes over and the shoulders come up again. In such cases, the therapist can use touch to help normalize the alpha-gamma relationships while also reducing chronic tension in the muscles.

THE TONUS SYSTEM

The tonus system is a function of the reticular formation, which is the part of the nervous system and brain that manages generalized tension levels in the muscle system. The Receptor-Tonus Technique was developed by Drs. Raymond Nimmo and James Vannerson, two chiropractors who created, extensively researched, and taught the Receptor-Tonus Technique, which is a forerunner of American neuromuscular therapy.¹ The reticular formation is located in the brainstem and mid-brain (Figure 5.1). According to *Anatomy & Physiology* by Saladin:

Some motor neurons of the cerebral cortex send their axons to the reticular formation nuclei. . . . These tracts modulate (adjust) muscle contraction to maintain tone, balance, and posture. The reticular formation also relays signals from the eyes and ears to the cerebellum so the cerebellum can integrate visual, auditory, and vestibular (balance and motion) stimuli into its role in motor coordination.

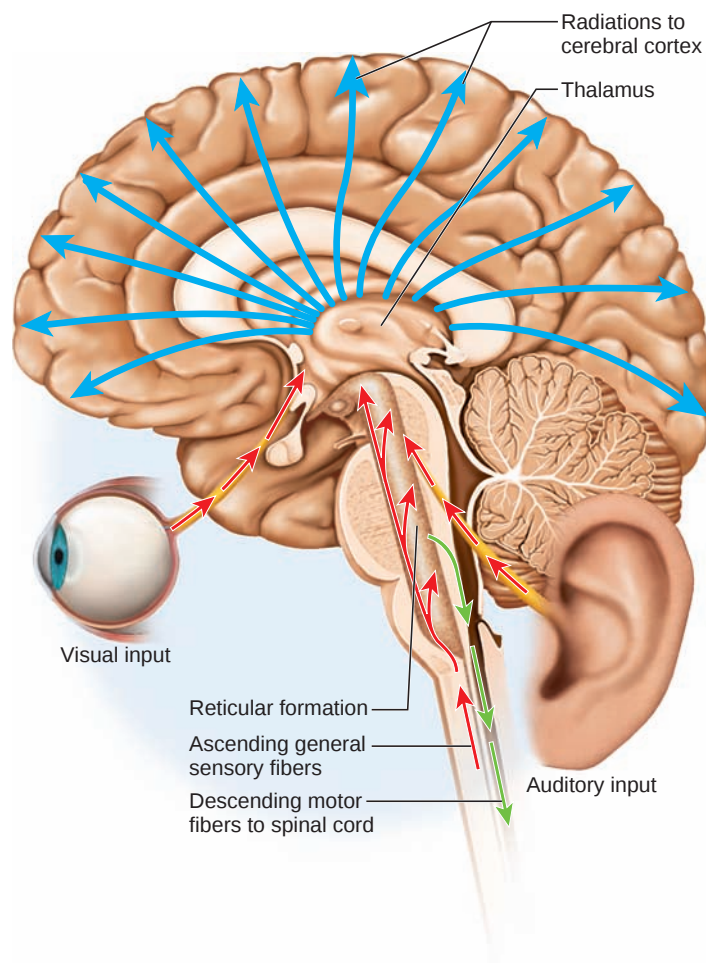


FIGURE 5.1 **The Reticular Formation**

¹ Raymond Nimmo, "The Receptors, Effectors and Tonus—A New Approach," *The Receptor*, vol. 1, no. 1.

This system is intimately involved in the production and maintenance of neuromuscular tension, posture, and movement, and it plays a significant role in the accumulation and retention of chronic, excess muscle and nerve tension.

The reticular activating system is also thought to be an important root cause of the waking state or consciousness. “The reticular formation has projections to the thalamus and cerebral cortex that allow it some control over what sensory signals reach the cerebrum and come to our conscious attention. It plays a central role in states of consciousness such as alertness and sleep. Injury to the reticular formation can result in irreversible coma” (Saladin).

It should be noted that consciousness *emerges from* the reticular structure, but it is not until the signals arrive and are integrated in the cerebral cortex that consciousness is experienced; therefore, the reticular formation and its activating system are generally outside direct, conscious control. Tools such as stretching, yoga, tai chi, bodywork, and so on, grant access to the tonus system via the movements and sensations these activities produce. The sensations travel through the nervous system to the deeper parts of the brain, where they can influence and hopefully normalize the events occurring in these deeper structures.

If the reticular system becomes overstimulated, as described by the law of generalization (from Pfluger’s neuromuscular laws), the whole body will assume an overly tense state. This law, probably better described as a principle, has fallen into disuse in orthodox medicine; however, it was revived by Nimmo and Vannerson and is now a key element of neuromuscular therapy as taught in the United States. Finding activities or processes with which to bring down the overall levels of reticular activation, or the background tension levels, in this system makes the process of muscle therapy easier.

STRUCTURAL HOMEOSTASIS

From a structural perspective, the body is constantly trying to find the proper relationship to gravity and other forces. Simple and complex reflexes create intricate responses to every change in the relationship of the body to its internal and external environments. The nervous system contracts or relaxes various groups of muscle fibers in relation to each other in an attempt to keep everything in a homeostatic, balanced, usually upright relationship. A well-trained clinical massage therapist can use these reflexes to her advantage in the treatment room.

GOLGI TENDON ORGANS

Golgi tendon organs (GTOs) are sensory nerve endings (Figure 5.2). About 10 percent of GTOs are embedded at the ends of each independent group of approximately 10 to 100 muscle fibers, where the muscle fibers terminate and become tendons. Their function is to measure the degree of pull at the ends of the specific muscle fibers they are attached to. When the degree of pull or force increases, the GTOs send a signal to the central nervous system, which in turn sends an inhibitory signal back through the motor nerve to the bellies of the same muscle fibers; this causes them to relax to the degree of the increased force. All other things being equal, this contributes to maintaining a fine balance in the neuromuscular system.

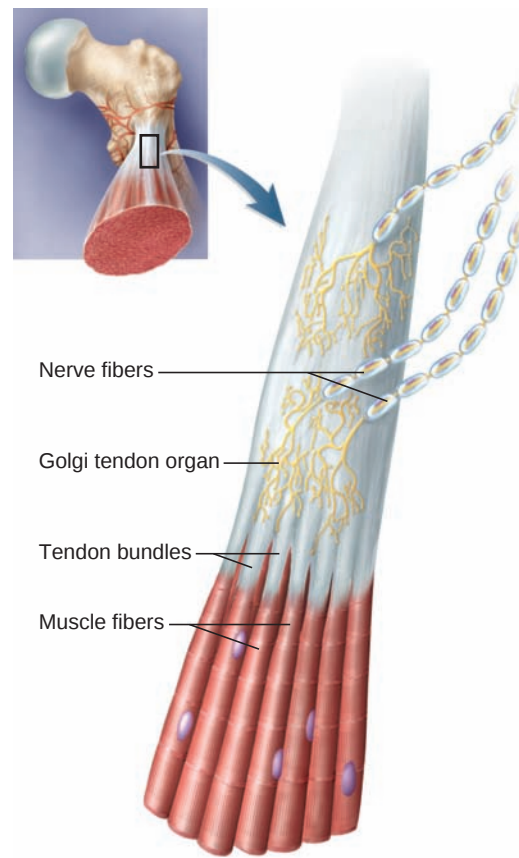


FIGURE 5.2 **A Golgi Tendon**

The GTOs were once thought to only monitor the pull on the tendon and help instantly relax the muscle to reduce injury; however, later research discovered that the GTOs continually report to the tonus system very fine degrees of increase or decrease, from slight to strong, of levels of pull or tension. The GTOs are thought to precisely measure and report any force generated by either pulling on the ends of a muscle or contracting the muscle fibers. Some research indicates that the GTOs measure any external force applied to a bone and therefore its tendon. For example, the GTOs in the biceps muscle tendons measure the muscular resistance to the weight of any object held in the hand or how much a muscle is stretching. This is believed to assist in informing the muscles of how forcefully, or not, to contract or relax. This measurement is necessary for the body to use different levels of force to pick up objects of different weight. It has been well substantiated, however, that the Golgi tendon organs are far more sensitive to changes in pull of the muscle fibers than they are to the muscle being pulled on from outside forces, such as in a typical stretching action.

Even later research claimed that the GTOs at the tendon ends are not very sensitive to external, passive stretching but are sensitive only to the amount of contraction or force generated by the muscle fibers. Regardless of this controversy, the application of manual pressure on the muscle fibers can transfer force to the GTOs, and this in turn stimulates a proportional, inhibitory signal to the muscle belly, causing it to relax. Therefore, as described in the next section, this neuromuscular function is a primary tool of the hands-on clinical massage therapist and structural bodyworker. This assumes that no other reflexes or reactions, such as pain, are triggered that will

override the very subtle sensitivities of the GTOs—another reason for respecting a client's edges as much as possible.

GTOS AND THE TONUS SYSTEM

The GTOs are a component of a neuromuscular feedback loop that runs from the GTOs through the CNS to the reticular formation (the tonus system in the brainstem and midbrain) and back to the muscle fibers. One theory contends that when a tendon is stretched by pulling on its ends, stretching its muscle fibers, or pressing into the muscle belly, the respective GTOs perceive an increase in the pull in the muscle fibers. Structural homeostasis will cause the tonus system to return the system back to perceived normal or, more practically, to what it was feeling moments before the activation of the GTOs. Scientific research has shown, however, that the GTOs are more responsive to changes within the muscle belly than to passive stretching when the ends of the tendons are pulled.² This may be one reason that manual therapy can produce tension release more efficiently and effectively than stretching the muscle can. While therapeutic stretching can be effective in many cases, the more extreme and/or long term the client's condition, the more results the client will sustain by initiating the healing process with manual therapy.

When the GTO is stimulated, it sends a signal to the CNS, reporting the increase in tension. If no overriding sensations of resistance register, such as pain, fear, distrust, excessive speed, or other resistance, the CNS will send an **inhibitory** signal to the muscle belly; this tells the muscle belly to relax an amount equal to the increase in pull reported by the GTO.

When attempting to maintain homeostasis, the overall tonus system responds to increases or decreases in tension by inhibiting or exciting muscles. An increase in pull on a muscle, as occurs in stretching, signals the tonus system to decrease tension in the muscle, causing it to relax and lengthen and allowing the body to sink deeper into the stretch. A decrease in the level of pull causes the muscle to contract and take up any new slack.

The same applies when the therapist is pressing on a muscle with her hands. Pressing on a muscle fiber stimulates its GTO, signaling the tonus system. If no other input is interfering and the pressure is within the client's edge, the tonus system will signal the muscle fibers to relax an equivalent amount. The longer the therapist maintains steady pressure on the muscle fibers, sinking in gradually deeper as the muscles relax, the more the GTOs will signal the increase in pull at the tendon and the more the tonus system will relax the muscle belly. This function of the GTO reflex is one reason to avoid cross-fiber or other rubbing, back-and-forth techniques if a complete change of state in, length of, and relaxation of the muscle is the objective.

Sensation as a Therapy Tool

Whether the client feels them or not, various inputs of conscious and unconscious sensation are the vehicles by which the soft-tissue therapist can affect change in the psychoneuromuscular system, central nervous system, and brain. The GTOs, as already discussed, are a source of unconscious sensation.

² Michael J. Alter, *Science of Flexibility*, 2nd ed., Human Kinetics, 1996, pp. 92–93.

Meissner Corpuscles and Merkel Receptors

The Meissner corpuscle and Merkel receptor nerve endings are very sensitive to pressure near the surface of the skin. Meissner corpuscles are quick responders, while Merkel receptors respond to slower pressures. When the therapist first applies light pressure to the client's skin, these are among the first nerve endings to perceive and report the activity to the CNS.

Ruffini and Pacinian Corpuscles

These sensory nerve endings are embedded deeper in the skin and are activated by slow and steady stretching of or pressure on the skin; however, the Ruffini corpuscles are deep enough to also act as mechanoreceptors of muscles. When an area is stretched or contracted, the underlying muscular movement stimulates the Ruffini stretch receptors and sends the information to the CNS. When muscles contract or relax, their motion affects the adjacent skin and likewise stimulates the Ruffini nerve endings, which inhibit sympathetic nerve activity—a primary objective of relaxation and healing. Pacinian corpuscles also are found in the periosteum.

One objective of bodywork is to restore the client's ability to feel and respond to sensation. As long as the sensations are pleasurable or positive, they can have a beneficial effect. Incoming sensation of any kind might be sufficient to assist in facilitating a relaxation response. The mechanism by which these inputs help to reduce chronic, excess muscle tension has not been well explained or documented.

When an area of the body is highly irritated, traumatized, and painful, one method of treatment is to apply just enough slight pressure to increase the activity of irritation the slightest amount possible; then wait and have the client focus his attention and breath. More often than not, the irritation will begin to subside within minutes. The key is to use the smallest *increase* of pressure possible and then hold steady to avoid further irritating the client's reflexive or volitional reactions. Because this is effective for treating highly irritated tissues, it also works in the background to treat less relevant issues; however, deeper pressure may be applied without invoking a strong reaction in the client.

Renshaw Cells

Renshaw cells contribute to a reflex arc. Renshaw cells, also called *Renshaw corpuscles*, are interneurons in the spinal cord that receive sensory information about activity in motor neurons in the periphery of the body. The periphery is anything outside the spinal cord. In response, Renshaw cells send inhibitory signals back out to corresponding motor neurons, which reduce the activity of the motor nerves and, hypothetically, for the purposes related to massage and bodywork, relax the muscles. It is further hypothesized that by stimulating the above-mentioned sensory organs, and with appropriate pressure in the tissues applied within the limits of the edge, Renshaw cells will contribute to the reduction in firing of the motor neurons to the muscle fibers, thereby reducing the level of tonus in those muscle fibers, resulting in relaxation.

PERPENDICULAR PRESSURE

The GTOs constantly report the slightest changes at each end of the muscle. If resistance is increasing at one end and decreasing an equal amount at the other end, the combined signals might cancel each other out and cause the tonus system to make no net change in the stimulation to the muscle belly. Therefore, if a therapist applies manual pressure toward one end of the muscle, that end will feel a decrease in GTO activity while the opposite end will feel an increase; consequently, there might not be as much change in overall tension levels. In most situations, it is advisable to stimulate the GTOs at the opposite ends of the same muscles as equally as possible to get the most reduction in tension. This is done by applying pressure in a more perpendicular angle to the muscle fibers being treated.

CONSTANT RELATIVE PRESSURE

If a particular muscle fiber group is chronically stressed and tensed, modifying the chemical bath at the synapses can take time. If the intent is to gain the most amount of neuromuscular relaxation possible in specific muscle fiber groups, using the reflex arcs to modify them is best served by keeping a steady, consistent flow of inhibitory signals to the target area; therefore, maintaining steady pressure, with minimal rubbing back and forth, will get the most amount of change in a specific group of fibers. From a structural-balancing point of view, this is the most efficient use of time and energy.

The guidelines related to perpendicular and constant pressure are not rigid rules. When muscles are less traumatized or less contracted, more generalized stroking, rubbing, cross-fiber, or even Swedish massage can be effective, especially if the sensations are pleasurable to the client. These guidelines should be followed when the main intent is to maximize the amount of structural change in the client's body.

PLAYING THE “EDGE” IN MASSAGE AND BODYWORK

One common complaint about bodywork and massage is that therapists work either “too deep” or “not deep enough.” A client's perception that pressure during the massage is not deep enough usually results in a less satisfying experience. This is not to say that light work will not produce results; however, it is necessary to ensure that the client's attention capacity and sensory conditionings will allow sensitivity and responsiveness to lighter work.

It is, therefore, important to coach the client so that she can focus attention on getting the most out of the sensory inputs; this involves many things, including relaxation techniques, breathing, and awareness. Ultimately, however, the client must not feel as though she did not get any benefit from the massage session. If a client desires deeper pressure, it is okay to press deeper as long as the pressure does not go over the client's edge. Conversely, working “too deep” often produces noticeable positive results but with more pain during treatment. Lastly, discovering a client's ever-changing edge is a lifelong internal process; therefore, it can be difficult to coach clients into finding theirs.

WHY NO PAIN MEANS MORE GAIN

Manual therapy stimulates the parasympathetic nerve functions of the body while calming the **sympathetic** functions. The **parasympathetic** function is a primary source of healing, rebuilding of tissue, rest, recuperation, immune function, and related activities.

Medical research indicates that many people in the West are caught in a state of excess sympathetic nerve activity, such as fight-or-flight and fright-or-freeze challenges. According to Joseph LeDoux in *The Synaptic Self*, the most common, actual sequence is fright, freeze, flight, fight. This state is usually reserved for emergency situations, but modern society, with its constant low-grade stimulation and repetitive stress situations, keeps people in varying states of sympathetic overload. Accidents and injuries also activate the sympathetics to varying degrees. The greater the injury or trauma, the more the sympathetics are in emergency mode.

Although the relationship is not a direct one, the belief is that the more the sympathetics are turned up, the less active the parasympathetics become, and vice versa. People with a lot of trauma often have significant, systemic, sympathetic stress patterns and little or no parasympathetic function. They are, to one degree or another, not healing or repairing the tissues and systems of their body on a day-to-day basis.

THE ARNDT-SCHULTZ PRINCIPLE: PARASYMPATHETIC HEALING

The Arndt-Schultz principle addresses the issue of parasympathetic versus sympathetic stimulation. It offers guidelines as to how much pressure or stimulation to apply in fitness, healing, and therapeutic scenarios. It also explains why, in many cases, therapy that hurts is too aggressive, fast, or intrusive and is often counterproductive, if not harmful, to the client. This depends on how much trauma and injury the client presents with.

The Arndt-Schultz Principle

The original definition of the Arndt-Schultz principle states the following:

- Weak stimuli **excite** physiologic activity.
- Moderate stimuli **favor** physiologic activity.
- Strong stimuli **inhibit** physiologic activity.
- Very strong stimuli **arrest** physiologic activity.

Taber's Cyclopedic Medical Dictionary, 20th edition, recently redefined it as follows:

Therapeutically applied energy (e.g., thermal agents, ultrasonic energy) must be of the proper intensity to stimulate the desired physiological response. Energy that lacks the needed intensity will not produce useful therapeutic effects. Energy that is applied at too great an intensity will destroy otherwise healthy biological responses. The Arndt-Schultz Principle is used to determine appropriate treatment dosages.

Based on extensive, hands-on experience, the Arndt-Schultz principle works extremely well in the context of noninvasive therapies.

Although translations of the original German texts from the 19th century are not definitive, the Arndt-Schultz principle has been assessed by researchers who determined that “physiologic” processes were intended to refer to the parasympathetic functions; however, earlier interpretations of this principle caused some therapists to believe that it was strong stimuli that would “arrest”

pathologic (rather than physiologic) activity. This approach caused an untold numbers of clients and patients over the last few decades to suffer through very painful treatments that were not always effective or were even counterproductive. Unfortunately, this attitude toward treatment by excessive manual pressure persists to this day. The modern-day, scientific version of the Arndt-Schultz principle is the growing science of **hormesis**. *Taber's 20th Cyclopedic Medical Dictionary* defines *hormesis* as “the stimulating effect of a small dose of a substance that is toxic in larger doses.” This principle applies to low-dose therapies of many kinds. It holds that many substances, though toxic at higher levels of exposure, actually initiate an immune function when administered at very low levels.

Arndt-Schultz Principle Applied to Bodywork

The following describes how to utilize the principles of Arndt-Schultz in manual therapy.

1. Minimum Edge: Weak Stimuli Excites Parasympathetic (Healing) Function

This is the first sign of any resistance, fear, or pain in the body or mind. The more a client has persistent pain, trauma, or high levels of stress, the closer the therapist should stay to the weaker levels of stimuli and sensation. In some cases, even a slight sense of tightness is the ideal level of pressure.

If the objective is to heal from high-level stress, injury, or trauma, then weak stimuli are key. The more trauma or stress the client presents with, the more the therapist should lean toward the weak stimuli in manual application of pressure, stretches, or exercise techniques. This provides the necessary stimuli to activate the healing functions of the parasympathetic nerve system while not stimulating sympathetic reactions that tense the body and mind.

Some traumatized clients need extraordinarily light touch to activate the healing processes without triggering negative, sympathetic reactions. Going too deep or too fast can put the client into sympathetic spasm and pain for very long periods of time. (Generally, unless the therapist practices in a hospital rehab clinic, clients with this level of trauma are not frequently encountered; however, such clients are more common than is often acknowledged.)

2. Moderate Edge: Moderate Stimuli Favors Parasympathetic Function

In theory, this is the ideal level of stimulation to keep the body functioning at optimum health; however, this applies primarily to people who are healthy and well-functioning.

For people who have no significant trauma, injuries, or health issues and have a balanced muscle-strengthening and relaxation program, this midrange level of intensity of function can work well. Yet all people must be diligent in preventing the development of chronic, excess muscle and nerve tension; therefore, it is best if such people include activities that move in both directions, from weak to strong stimuli, on the scale of intensity. The weaker stimuli will keep the body more relaxed and the parasympathetics active. Stronger stimuli will build more strength, endurance, and cardiovascular function—the domain of the sympathetics.

3. Maximum Edge: Strong Stimuli Inhibits Parasympathetic Function

This is the maximum amount of sensation at the client's limits before pain and fear, and in regard to fitness (strength, endurance, and cardiovascular function) it produces the most results with no or little short- or long-term detriment.

If the objective is to build higher levels of muscular and cardiovascular fitness with equally high levels of strength and endurance, stronger stimuli are warranted and beneficial; however, as the law states, this level of intensity tends to temporarily turn down the parasympathetic healing processes. In a healthy person, however, they should return to proper functional parasympathetic levels after a brief recovery period.

4. Over the Edge: Very Strong Stimuli Arrests Parasympathetic Function

This is the fright, freeze, flight, or fight stage. Here, the healing and immune functions, for the most part, shut down—dramatically so in extreme conditions and over extended periods of time.

People who engage only in very intense exercise with no relaxation often increase the likelihood of breaking down their general health and immune system. While this kind of intensity might be necessary for those who want to develop extreme levels of muscular bulk, it is often at the expense of fundamental health. This especially applies to people who attempt to “work through the pain” in their fitness or sports activities.

It should be noted that some people are so traumatized that even mild stimuli heighten the sympathetic reactivity and put them over the edge, if they are not already there.

WORKING WITH THE EDGE

Selecting or discovering the appropriate level of pressure with which to work requires that a therapist develop physical and psychoemotional sensitivity and learn to make mental distinctions about levels of pressure and their effect on a client.

A critical distinction is the client’s sense of whether the amount of pressure is appropriate for the tissues being addressed. The client’s physical, mental, and emotional states are all factors. Ultimately, the client should never be in the position of tolerating the treatment, even if the client believes that it would be good.

Coaching the client to effectively communicate about her sensations is important to maintain reactions that are not counterproductive. An effective therapist will learn to coach a client in this self-exploratory process. The therapist must also be careful that his physical or mental states do not inhibit his sensitivity and responsiveness to the client.

The three distinctions of sensation, called the *edge of pain, fear, and resistance*, give the therapist and client a starting point for interacting about the client’s sensations.

RECOGNIZING AND WORKING WITH THE LEVELS OF THE EDGE

It is important to recognize that edges move—sometimes a lot and sometimes constantly. Edges are seldom static. The object is to move as the edge moves; this is why therapists must remember to communicate with the client while working with their levels of edge.

It is also important to avoid certain assumptions, such as the erroneous assumption that tight or hardened tissues are always painful; they very often are not. A rock-hard muscle can have no pain, while soft, seemingly flaccid tissue can be very painful. Although one’s sense of pain and the control of muscle tension originate from two different parts of the nervous system, the two are

interrelated and interactive. Still, they do not always talk to each other, and descending (inhibitory) sensory pathways can interfere with the client's awareness.

MAXIMUM EDGE

In a healthy person, the maximum edge is the level of intensity just before pain. Potential over-the-edge consequences include tight or painful muscles, resistance to the same activity later on, the reaching of a plateau relative to improvement, and others. Sometimes negative results are delayed for hours or days afterward. For most people who have any awareness of the edge, the maximum edge is what they are most familiar with. Unfortunately, however, many people have assessed the edge to be what they could tolerate or “deal with,” rather than what has been described in this text. This is potentially dangerous.

MINIMUM EDGE

The minimum edge is the very first sign of resistance. It is not usually manifested as pain, unless the client is already severely stressed, injured, or traumatized. Most of the time, this level of resistance is too subtle for the client to notice. In highly traumatized clients, it is important to reach this first layer of resistance and let it release as fully as possible; then carefully and slowly go to the next layer. Therapists should not attempt to push this edge until the client has had significant relaxation in the general area of the work.

Resistance in the tissue often shows up before the client feels or notices any pain, sensation, or fear. Sometimes, the therapist must stop at that level until the tissue softens, even if the client feels nothing, because there is a high likelihood of triggering a stretch or withdrawal reflex, which is counterproductive according to the Arndt-Schultz principle.

MODERATE EDGE

The moderate edge is the wide range of sensation between the minimum and maximum edges. The therapist has a wide range of latitude in working here. It is far less defined and largely experimental for both the therapist and the client. Becoming familiar with the minimum and maximum edges first and then exploring degrees of sensation within the moderate edge is the ideal.

CLIENT TO THERAPIST COMMUNICATION

The simple terms listed below can help a client communicate with the therapist about how to work with various levels of pressure. In accessing a meditative and parasympathetic state, the less effort the client expends communicating, the better; paradoxically, however, being able to verbalize her experiences can be valuable to the overall healing process. One suggestion is to have the client describe her relationship to the edge using simple words.

Deeper: Increase the pressure.

Edge: Maintain relative pressure.

Less: Reduce the pressure.

Slower: Follow the release less aggressively.

Hold: Don't go any deeper.

Stop: Immediately cease pressure.

Advise the client that his or her silence is an indication that the pressure is right on the edge. Your client is always sovereign in the realm of "how deep."

DESENSITIZATION: DESCENDING SENSORY PATHWAYS

Desensitization—also called **habituation**—prevents important data from arriving where it will do the most good: the conscious mind, where it can be perceived, intelligently processed, and responded to.

Ascending sensory nerve pathways deliver sensory information to the CNS and brain. **Descending motor nerve pathways** deliver commands from the brain and CNS to the muscles and organs, instructing them to turn on or off. **Descending sensory nerve pathways** within the brain selectively amplify or diminish incoming sensory input, often magnifying it out of proportion, on the one hand, or completely blocking it from reaching the cerebral cortex, on the other. This neurologic phenomenon occurs to block irrelevant or repetitive sensory input that would overwhelm the conscious part of the brain if allowed to reach the cerebral cortex. The cerebral cortex is capable of processing an average of only .00007 percent of the information traveling throughout the body at any given time—that is 7 out of every 100,000 bits of data.

One simplistic example of this phenomenon is getting dressed in the morning. A person feels the clothing making contact with the skin for a short period of time; then the sensation quickly fades into the background, and it is not perceived or noticed again, unless something unusual happens or the person's attention is called to it. If the body were feeling and perceiving every little event happening all the time, the human mind would be unable to function.

RECLAIMING THE CLIENT'S AWARENESS

Because sensory input or block-out exists at a preconscious level, a person has no direct control over it. The first challenge for a desensitized client is for him to discover what it feels like to *not* feel. To facilitate this, the therapist must ask some basic questions to focus the client's awareness. For example, asking the client if he can feel the pressure of the therapist's hand might seem too basic, but it is not. One secret to effective massage therapy is, if possible, to never ask a question that the client cannot easily answer. In most cases this strategy will start the process of unblocking the client's mind and help to focus awareness.

For many people, the desensitizing physiology of the nervous system can create resistance to feeling. Thus, some clients are unable to distinguish whether they are over their edge. For example, yoga instructors, when stretching, may be unaware that they are stretching too deeply because sensation is not activated until they are already deep into the stretch. Many yoga teachers who are very flexible have significant pain and dysfunction because they have been stretching with a lot of intensity for a long time and their descending nerve pathways have desensitized and blocked the feelings of tension and related sensation. The end result is that they have to feel *a lot* to feel anything at all. This is also potentially true of gymnasts, dancers, athletes, and others who use their body in a similar fashion.

One strategy is to ask these clients when they think they are halfway toward their edge. Quite often, they will be right around, if not over, their edge when they think they are only at 50 percent.

RESTORING THE ABILITY TO FEEL

When it comes to body and mind responsiveness, it is more difficult to change what one cannot feel. A person who cannot detect tensions in the body cannot consciously relax them.

Paradoxically, many, if not most, of the feelings or sensations of the body are not consciously felt. As mentioned earlier, the descending sensory pathways inhibit much of this sensation. Additionally, most sensory nerve pathways—the GTOs and muscle spindles, for example—terminate prior to the cerebral cortex and have no channel through which they can make their way to the conscious part of the brain. The CNS and the brain process most sensory inputs without any help from the conscious part of the mind and will never be consciously felt, even though they are delivering tremendous amounts of information. Yet the more perceptive one can become, the more intelligently one can use the data and the more effectively one can manage the body and mind.

Restoring and deepening the ability to feel and intelligently respond to data assists the client in maintaining her well-being once normal function has been restored. The effective massage therapist helps the client learn to feel and evaluate sensations that have been there but were not perceived. As these sensations surface, the client will develop a new sense of her body and mind processes and will be able to provide increasingly precise feedback to the therapist.

LAYER BY LAYER AND HIDDEN NEUROTAPS

Nerves are usually involved in producing pain responses. There are many opportunities for a muscle to irritate, impinge, or compress a nerve fiber or nerve trunk. Shrinking, gluing, and/or hardening fascia can also irritate a nerve fiber. They could informally be called “neurotraps.” Releasing these traps is a major function of clinical massage therapy; determining their source is the domain of structural bodywork and analysis.

One challenge in administering neuromuscular, myofascial, and structural therapy properly is that the layer of muscle or fascia that is irritating the relevant nerve is often located deep within the muscle belly. Pressing hard to find it usually further tightens the surrounding myofascial fibers, which are already hardened from tension, stress, and/or injury in order to protect the irritated fibers. In this case, the more superficial or surrounding fibers are guarding or encasing the most irritated fibers. In fact, much of the body’s tension is compensatory and protective to prevent further invasion, injury, or imbalance. A layer of irritated or painful tissue might be close to the surface, but it can go unnoticed if too much pressure is exerted too fast and too deep. Occasionally, however, the problem layer that both the therapist and the client believed was very deep in the muscles was actually on the surface of the skin. This is the nature of neurofascial irritation in the skin or superficial fascia, which is extremely thin and close to the surface. Many therapists and clients are surprised to find how much pain can manifest in the surface tissues and go unnoticed until the tissues are slowly and gently palpated.

DEEP INTO THE NERVOUS SYSTEM

The key is for the therapist to focus on using the muscles to work deep into the nervous system, as this will engage the appropriate, relevant nerve endings and initiate the proper inhibition of muscular tonus, thereby producing relaxation and lengthening the muscle fibers. This noninvasive method allows the therapist to take his time and communicate with the nerves by way of the skin, fasciae, and muscle fibers.

TIME

The objective of this therapy is to affect an inhibition of the synapse so that its chemical bath can return to a more normal state and reduce its chronic charge to the muscle and/or organ it controls. Whether in a stretch or with manual pressure, the object is to stimulate the appropriate sensory nerves, which in turn initiate an inhibitory motor reflex in the spinal cord, turning off the flow of tonus to the involved synapses. This allows the synapse time in an uncharged state to return to a less chronically facilitated state.

The time it takes to complete this process depends on the client's history, including prior traumas, accidents and injuries, and attitudes and stress levels. Lifestyle choices are a huge factor in how chronically facilitated a synapse is and how much time it will take to defacilitate it.

FASCIA VERSUS MUSCLE

With the exception of the superficial fascia just under the skin, the fascial sheaths and muscles are so intimately wrapped and integrated that it is nearly impossible to treat them separately, whether one is applying manual pressure or stretching the tissues.

The proper application of effective bodywork techniques accommodates the distinct characteristics of both muscle and fascia without distinguishing between them while the local tissue is being treated. An exception to this occurs when the superficial fascia and skin are treated using the edge technique to defacilitate the nerve endings embedded in the superficial tissues. This is called *neurofascial release*.

IMPLICATIONS

When engaging in flexibility exercises, many people focus on bending at the joints; this is sometimes called *static stretching*. They often exert significant degrees of force to accomplish the bending, and this can often lead to injury. One misconception is that a person can condition the muscles to stretch out more (mistaken for elasticity) through repetitive action or deep, intense leverage on the muscles. This is a poor model for musculoskeletal and neuromuscular health. Muscle fibers are, for the most part, not elastic, and they cannot be stretched out in the elastic sense of the word; moreover, joints bend only when a muscle relaxes sufficiently to allow the lengthening of the muscle fibers. True stretching that is not dangerous requires a different model.

The genuine health benefits of stretching come more from developing **extensibility** of the muscles, which is the process of learning how to relax them. This relaxation results from learning to turn off the nerve charge to the actin-myosin units. The ability to bend the joints is secondary to the relaxation, which allows lengthening of muscle-tendon units. Attempts to treat muscles, tendons, and ligaments as if they were supposed to be elastic can, in fact, damage them and related structures of the musculoskeletal system.

The flexibility and resilience of the tissues is enhanced by relaxation, metabolic health, and proper hydration. Relaxation of muscle fibers is the turning off of the biochemical or electrical charge that activates the actin-myosin ratcheting effect.

The clinical massage therapist assists in teaching the client to feel, relax, lengthen, and balance the muscles of the body, and this has other benefits. Effectively and appropriately working with the actin-myosin deactivation process also properly addresses the nerves, fasciae, joints, and other related systems of the body.

WARMING UP TISSUES FOR TREATMENT

Massage students are usually taught to warm up a client's muscles and tissues to prepare for stretching or deep-tissue massage. However, when it comes to long-term healing and mind-body integration, this approach can be problematic.

Many neuromuscular tensions have a psychological and/or emotional component. That is, many muscular tensions are held in place by psychoemotional processes. They also have a significant relationship to brain activity, even if a psychoemotional element is minimal or nonexistent. The holistic application of massage and bodywork provides an opportunity for a client to explore how he is holding these tensions in place vis-à-vis the unconscious mind.

Warming up the tissues through strictly external physical means provides only a superficial loosening of tissues. Massage or stretching allows for greater results only at the strictly physical level within the local tissues. What is lost is the client's opportunity to feel, relax, and lengthen the muscles by discovering the volitional and/or mental components that exist at the root of many of the tensions.

It is better for the therapist to start treatment by simply respecting the client's minimum edge and then working deeper as the tissues relax. This prevents damage to the tissues while allowing the client to feel and experience the full range of mental, emotional, and physical aspects of psychoneuromuscular tensions.

Working first with the client's minimum edge before moving toward the moderate to maximum edges provides all the protective elements necessary without depriving the client. When this approach is followed, there is little risk of damage and there is a potentially wider range of benefit. Working with the client's minimum edge is the most important stage of the so-called warm-up process; if more aggressive activities are desired, a more active form of warming up may then be implemented after the initial minimum-edge, psychoneuromuscular warm-up has been achieved.

BRIEF SUMMARY

Implementing lighter and slower movements at the onset of treatment can produce profound results over the long term. Administering treatment in this way allows the therapist to eventually go deeper into the tissues if necessary. Working with the various nerve structures and within the client's edges and limitations produces more effective and long-lasting therapeutic results.

REVIEW QUESTIONS

1. What kinds of sensations could make clients disassociate from what they are feeling?

2. What is the difference between a reflexive release and a volitional release?

3. Explain how the Arndt-Schultz principle addresses the physiologic activity of the parasympathetic and sympathetic functions.

4. What do the Arndt-Shultz principle and hormesis have in common?

5. List and define the levels of the edge.

SECTION II

CLINICAL MASSAGE THERAPY AND STRUCTURAL BODYWORK

Chapter 6: **POSTERIOR LOWER-EXTREMITY COMPARTMENT (PLEC)**

Chapter 7: **ANTERIOR TORSO COMPARTMENT (ATC)**

Chapter 8: **ANTERIOR LOWER-EXTREMITY COMPARTMENT (ALEC)**

Chapter 9: **POSTERIOR TORSO COMPARTMENT (PTC)**

Chapter 10: **UPPER-EXTREMITY COMPARTMENT (UEC)**



CHAPTER 6
POSTERIOR LOWER-EXTREMITY
COMPARTMENT (PLEC)

LEARNING OUTCOMES

After completing this chapter, you will be able to:

- 6.1 List and identify the muscles of the PLEC.
- 6.2 Define the origins and insertions of the muscles of the PLEC.
- 6.3 Describe the actions of the muscles of the PLEC.
- 6.4 Recognize the pain patterns of the PLEC.
- 6.5 Discuss the clinical notes for and the importance of treating the muscles of the PLEC.
- 6.6 Demonstrate the client positioning and treatment routines of the PLEC.
- 6.7 Demonstrate safe and effective stretching techniques for the muscles of the PLEC.

OVERVIEW

This chapter focuses on the posterior lower-extremity compartment (PLEC)—the first of five muscle compartments discussed in Section II—and Chapter 7 covers the anterior torso compartment (ATC). These two chapters collectively address posterior pelvic tilts that cause stooped or collapsed postures.

The muscles of the PLEC and ATC play a significant role in many postural imbalances that cause pain. Therefore, the PLEC and ATC chapters are arranged in specific order to illustrate why it is so important that these two compartments be treated together and in this sequence.

Plantar fasciitis is an inflammatory condition that can arise from chronic muscle tension in the calf muscles, primarily the soleus muscle. Also, it takes focused attention to isolate the popliteus muscle located in the popliteal fossa. A skilled massage/bodywork therapist can apply techniques to this muscle that will assist in restoring proper functioning to a person's knee that is stiff from a torsion injury.

Chronically shortened hamstring muscles can directly impact the muscular and fascial chain throughout the entire body. The hamstring muscles can directly pull the pelvis into a posterior rotated position that causes the curvature of the lumbar spine to straighten; this increases the intrajoint pressure on the spinal disks and spinal joints. The hamstrings have a lot to do with chronic back conditions, which can often lead to misdiagnosed conditions that are simply treated ineffectively if the causative factors in the shortened hamstrings are not recognized and addressed.

The gluteus medius and gluteus minimus mimic classic sacroiliac joint dysfunction and refer pseudo-sciatic pain down the leg. These symptoms often lead to “labeling” these afflictions to joint and disk pathologies.

In this chapter students will learn how to release and lengthen muscles of the PLEC effectively and efficiently by using their hands as well as their body weight, using their forearms, knees, and feet.

CLINICAL SUCCESS

A female triathlete was complaining of severe, acute recurring pain in her left heel. The client had been competing in running, swimming, and cycling events for 25 years. Pain would occur each morning on walking, and the symptoms would decrease gradually as the day went on. She had been prescribed anti-inflammatory medication and a soft Velcro brace that she wore during sleep to immobilize the foot and ankle at a 90-degree angle in order to keep the calf muscles and the Achilles tendon elongated.

The client was placed in the supine position, and the therapist started with straight leg stretches on each leg. The therapist evaluated the tightness of the hamstring muscle while performing dorsiflexion movements of the ankle and checking the tightness of the calf muscles. One measurement for evaluating the flexibility of the posterior lower-extremity compartment is that the leg should straighten at a 90-degree angle, or close to it, from the therapy table with minimal strain in the hamstring muscles and/or discomfort in the lower back. In this case, the client had extreme difficulty straightening each leg; this was even more evident on the affected left side. Her medical doctor diagnosed her condition as plantar fasciitis: inflamed plantar fascia in the ankle that often results from overly contracted, tight muscles that attach to the heel.

The client was asked to turn over in the prone position with her feet hanging off the therapy table. Treatment consisted of applying deep, broad compressions across the hamstring muscles. As her comfort level would allow, treatment was moved deeper into the muscle bellies (while maintaining her edge), allowing the client time to adjust comfortably to the added pressure. Treatment was maintained with deep, broad compressions for approximately 20 minutes on each hamstring group, with additional time spent on the tighter left side.

Next, the left knee was bent and the lower leg was rested on the therapist's shoulder girdle. The therapist's fingers were positioned in the popliteal fossa. After the therapist carefully palpated the endangerment site, the popliteus muscle was treated with compression and cross-fiber friction. Treatment to the hamstring muscles and to the connector muscle behind the knee was completed, followed by treatment to the soleus muscle, which is the primary plantar flexor of the ankle and likely a contributing source of the plantar fasciitis. The soleus and gastrocnemius muscles were treated, using fingertip compression while gliding, separating the muscular divisions between the gastrocnemius heads and deeper between the two muscle bellies of the gastrocnemius to directly compress the soleus. Static compression and maintaining edge was administered to tender points until the discomfort and excessive tension decreased. Lastly, the therapist stretched the calf muscles by dorsiflexing the ankle while the foot was hanging freely off the table and scraped the plantar fascia on the bottom of the heel with a massage tool to decrease the possibility of a bone spur forming.

FLEXOR DIGITORUM BREVIS, FIGURES 6.1 AND 6.2

ORIGIN Calcaneus

INSERTION Posterior middle phalanges of the four lateral toes

ACTION Flexion of toes

MYOTOME L4, L5, S1, S2

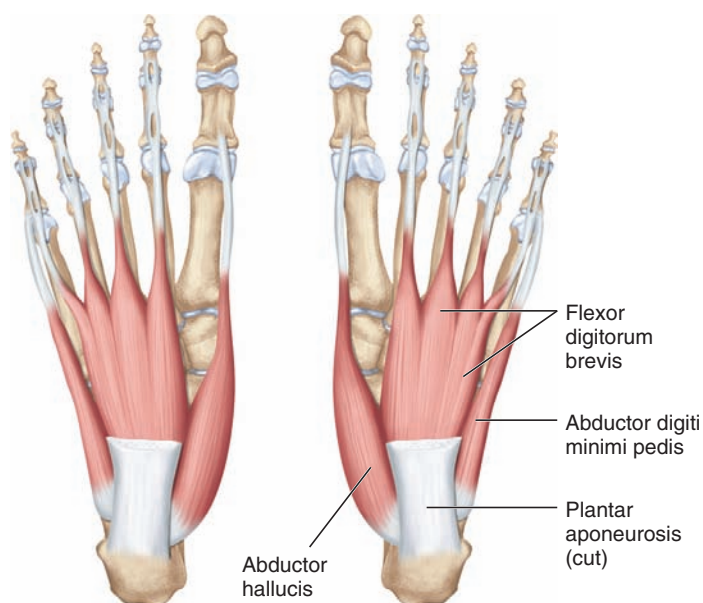


FIGURE 6.1 **Flexor Digitorum Brevis, Abductor Digiti Minimi, and Abductor Hallucis Muscles**

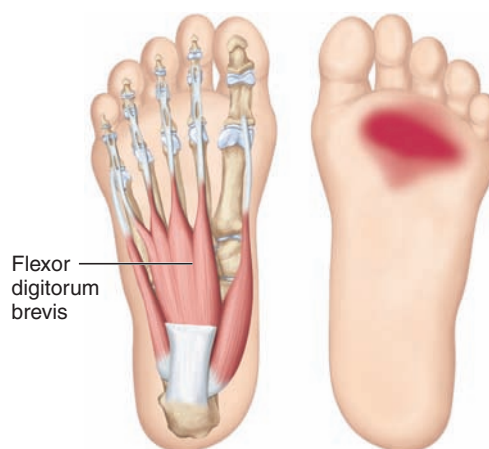


FIGURE 6.2 **Flexor Digitorum Brevis Muscle and Referred Pain Pattern**

ABDUCTOR DIGITI MINIMI, FIGURES 6.1 AND 6.3

ORIGIN	Calcaneus
INSERTION	Base of proximal phalanx of 5th digit (little toe)
ACTION	Flexion and abduction of 5th digit (little toe)
MYOTOME	S1, S2, S3

ABDUCTOR HALLUCIS, FIGURES 6.1 AND 6.4

ORIGIN	Calcaneus
INSERTION	Base of medial proximal phalanx of 1st digit (great toe)
ACTION	Flexion and abduction of 1st digit (great toe)
MYOTOME	L4, L5, S1, S2

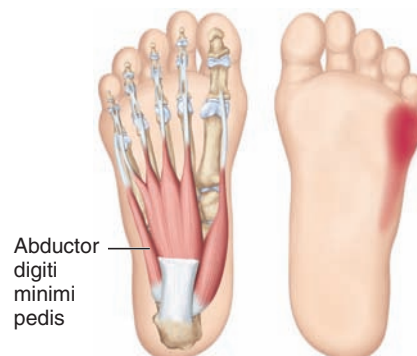


FIGURE 6.3 **Abductor Digiti Minimi Muscle and Referred Pain Pattern**

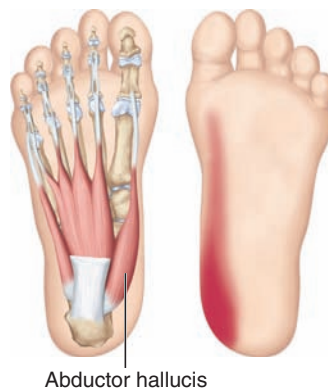


FIGURE 6.4 **Abductor Hallucis Muscle and Referred Pain Pattern**

CLINICAL NOTES: Flexor Digitorum Brevis, Abductor Digiti Minimi, and Abductor Hallucis

The flexor digitorum brevis, abductor digiti minimi, and abductor hallucis have a common origin on the calcaneus and run along the plantar surface of the foot. The flexor digitorum brevis muscle lies midline on the sole of the foot and is largely covered by the central portion of the plantar aponeurosis. The abductor digiti minimi muscle lies on the lateral sole of the foot and attaches distally at the 5th toe. The abductor hallucis muscle lies on the medial sole of the foot and attaches distally at the great toe.

The flexor digitorum brevis, abductor digiti minimi, abductor hallucis, and deep intrinsic muscles of the foot function as a unit to provide flexibility, shock absorption, balance, and stability during standing and walking. Propulsion comes from the foot muscles (i.e., toe flexors); locomotion comes from the leg muscles.

Pain associated with trigger points of the flexor digitorum brevis and the abductor digiti minimi will likely be deep within the metatarsal joints of their distal attachments. The pain referral pattern of the abductor hallucis will likely be to the medial side of the heel, spilling over distally to the instep and arch of the foot. This pain pattern is similar to that of the calf muscles. The gastrocnemius muscle usually refers pain directly to the arch of the foot. A direct, sharp pain that encompasses the entire plantar surface of the heel will most likely involve the soleus muscle. Referral pain from the quadratus plantae muscle lying deep to the plantar aponeurosis can also “fire up” the heel, similar to the soleus muscle.

Hypermobility from ligament laxity can perpetuate high tension levels in the muscles of the foot and ankle, as seen with flat feet. Tight shoes that restrict movement can also cause muscular pain. Hypomobility resulting from the muscles' inability to fully elongate will restrict blood flow and could entrap local nerve fibers. The nerves in the foot stem from nerves in the lumbosacral junction. If there is pain in the lower extremities, disk compression should always be ruled out.

Tension overload from increased athletic activity combined with inadequate flexibility and conditioning can perpetuate a degenerative process and chronic inflammation to the foot and ankle, commonly known as *plantar fasciitis*. People who suffer from plantar fasciitis will experience difficulty in the early morning hours as they first become weight-bearing. A sharp, shooting pain will be most noticeable during the first 10 to 20 steps. A person may assume an antalgic gait (limp) to avoid or lessen the pain. The intensity of pain usually decreases after the muscles warm up and blood flow increases, but the pain returns the next morning.

Massage, stretching, reduced activity, and orthotic corrections are some of the corrective actions to consider when pain is persistent throughout the calf, ankle, and foot.

ROUTINE: Flexor Digitorum Brevis, Abductor Digiti Minimi, and Abductor Hallucis

Position of client: prone, with ankles and feet hanging off the therapy table. (See Figure 6.5.) This puts the client's muscles in a lengthened position. Bolstering the ankles puts the client's muscles in a shortened position. The objective of clinical massage therapy and structural bodywork is to lengthen muscles, as doing so addresses the cause, rather than "giving in" to the symptoms, as seen quite often with bolstering methods.

1. Using the fingertips, treat the PLEC with slow, deep effleurage from the Achilles tendon to the ischial tuberosity, separating the muscular divisions of the calf muscles and the hamstring muscles. (See Figure 6.6.)
2. Bend the client's knee, stabilize the foot, and slightly dorsiflex the ankle. (See Figure 6.7.)
3. Using the fingertips, treat the muscles of the plantar surface of the foot with slow, deep effleurage from the metatarsal-phalangeal joints to the heel. (See Figure 6.8.)
4. Using the thumbs, follow the tendon lines of each toe toward the heel. Treat each muscle emerging from the tendon with static compression, circular friction, and cross-fiber friction. *Frictions should be performed slowly, rhythmically, and in one direction. Avoid overly aggressive back-and-forth friction as this can create pain and tensing of the client.*

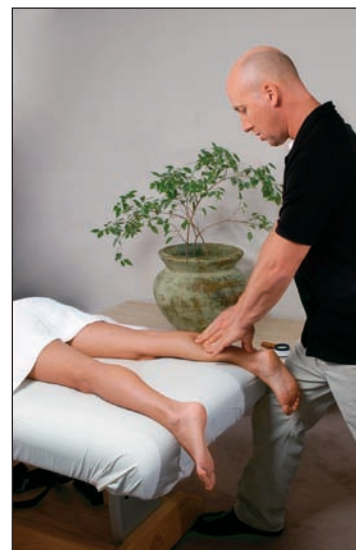


FIGURE 6.5

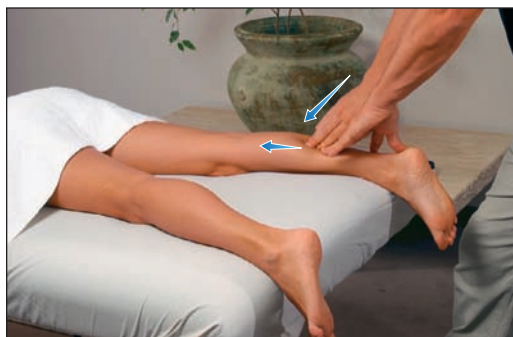


FIGURE 6.6



FIGURE 6.7



FIGURE 6.8



FIGURE 6.9

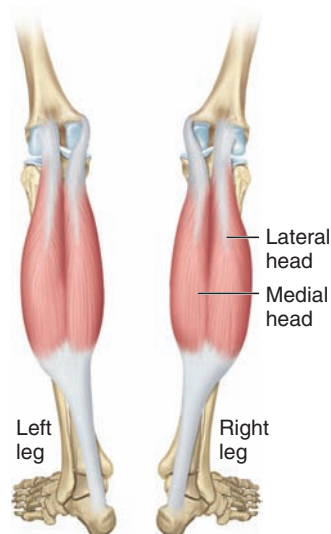


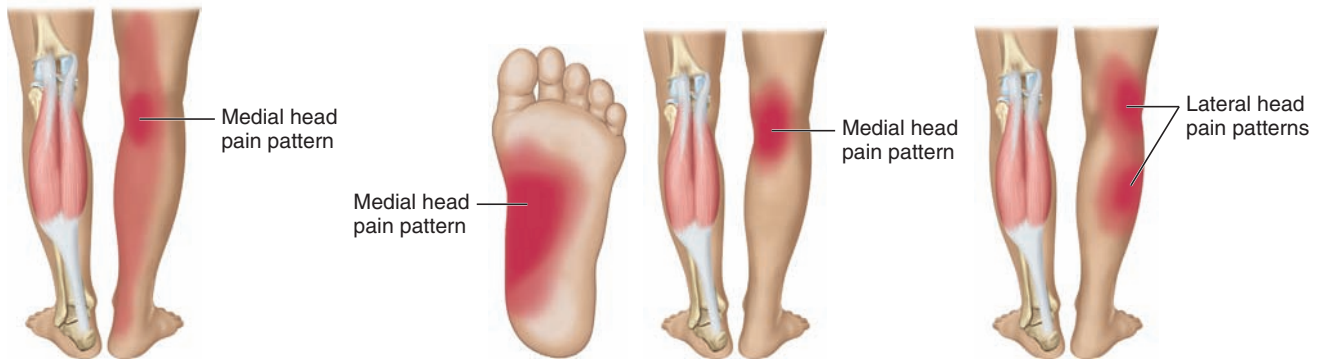
FIGURE 6.10

5. Find the plantar aponeurosis at its attachment to the calcaneus bone. *This “is” the common site of heel pain, inflammation, and bone spurs. (See Figure 6.9.) Treat with compression and cross-fiber friction. Stabilize the heel.*
6. Using the palm, effleurage the entire plantar surface of the foot as shown in Figure 6.10.

GASTROCNEMIUS, FIGURES 6.11 AND 6.12

ORIGIN	<i>Lateral head: lateral condyle and posterior surface of femur Medial head: medial condyle and posterior surface of femur</i>
INSERTION	Posterior surface of calcaneus via Achilles tendon
ACTION	Plantar flexes ankle; flexes leg at knee
MYOTOME	S1, S2

FIGURE 6.11 **Gastrocnemius Muscles, Lateral and Medial Heads**

FIGURE 6.12 **Gastrocnemius Muscle and Referred Pain Patterns**

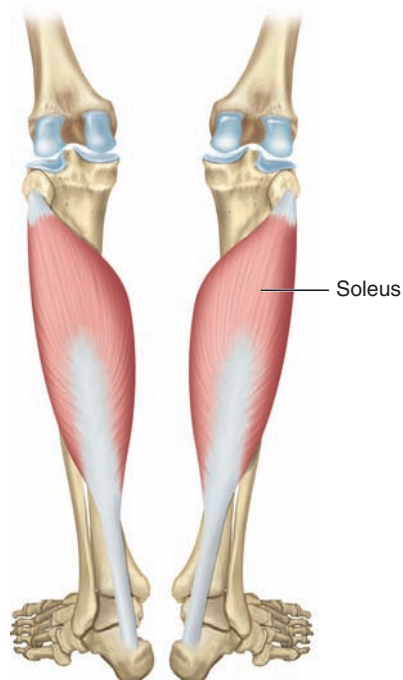
SOLEUS, FIGURES 6.13 AND 6.14

ORIGIN Posterior shaft of tibia, posterior head of fibula, fibrous arch between tibia and fibula

INSERTION Posterior surface of calcaneus via Achilles tendon

ACTION Plantar flexes ankle

MYOTOME S1, S2

FIGURE 6.13 **Soleus Muscles**

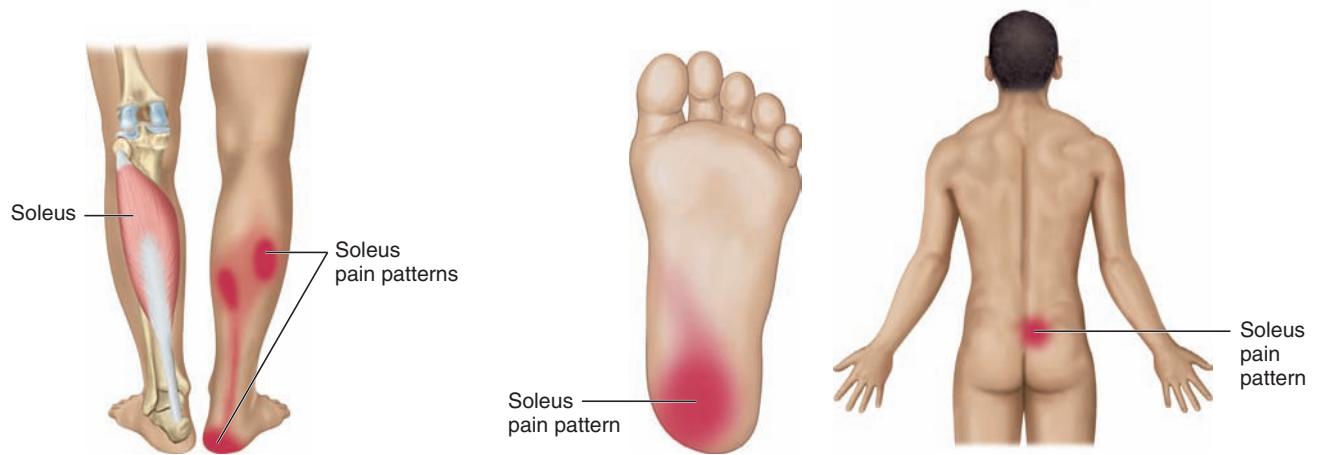


FIGURE 6.14 **Soleus Muscle and Referred Pain Patterns**

PLANTARIS, FIGURES 6.15 AND 6.16

ORIGIN	Lateral epicondyle of femur
INSERTION	Posterior calcaneus via Achilles tendon
ACTION	Plantar flexes ankle; flexes leg at knee
MYOTOME	L4, L5, S1

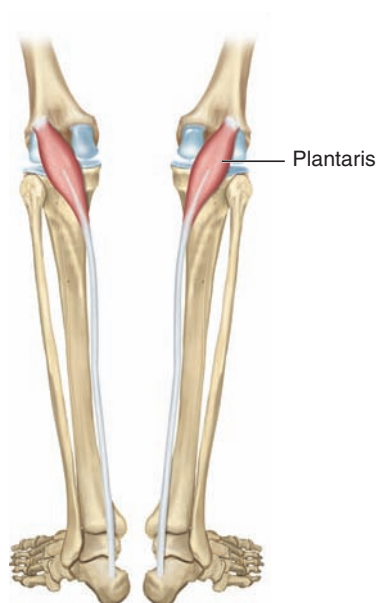


FIGURE 6.15 **Plantaris Muscles**

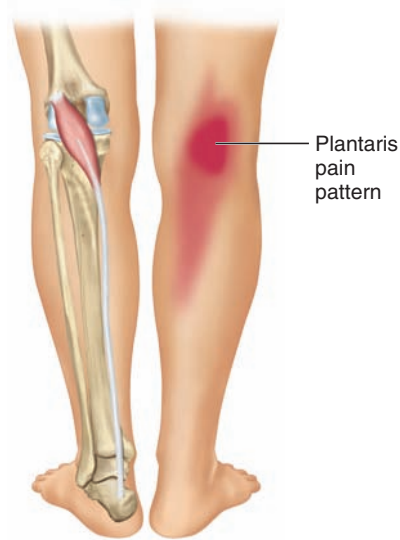


FIGURE 6.16 **Plantaris Muscle and Referred Pain Pattern**

CLINICAL NOTES: Gastrocnemius, Soleus, and Plantaris

The gastrocnemius and soleus muscles make up most of the calf. The superficial gastrocnemius muscle has two distinct bellies—a medial and a lateral—that are palpated on the proximal half of the calf. The flat, broad, powerful soleus muscle lies directly underneath the gastrocnemius and covers the entire calf surface. Distally, they merge with the plantaris muscle to form the Achilles tendon—the strongest tendon in the body.

The soleus is a one-joint muscle and is the primary plantar flexor of the ankle. The gastrocnemius is a two-joint muscle that rations its strength between plantar flexion of the ankle and flexion of the knee. The calf muscles and Achilles tendon, which anchors itself to the periosteum of the calcaneus bone, are vital in promoting stability of the foot, ankle, and knee in a weight-bearing stance and during movements anterior to the frontal plane.

The gastrocnemius has a distinct pain referral zone in the arch of the foot, as well as locally within the medial and lateral bellies of the muscle just below the knee. The soleus is often overlooked as a source of pain in the bottom of the heel and Achilles tendon.

Peripheral varicosities and swelling of the ankles are often associated with pain and restriction among the deep plantar flexors, primarily the soleus. Sinuses in the soleus are compressed by the muscle's strong contractions, and its venous blood is forced upward toward the heart. This pumping action is what gave the soleus its nickname, "the body's second heart." When the soleus muscle is restricted, this action is also restricted.

Doing step aerobics, running up steep slopes, and wearing high-heeled shoes are just some factors that can cause chronic excess muscle and nerve tension and trigger point formation in the calves and subsequently refer pain. Recreational runners can experience an increased soreness and tightness in the calf area from jogging in soft sand. This is due to increased stimuli from the mechanical overload required to maintain balance.

Plantar fasciitis, Achilles tendonitis, and shin splints can be attributed to chronic shortening of the calf muscle group. Chronic muscle and nerve tension in the calf will cause the Achilles tendon to tighten, often leading to a bone spur on the plantar surface of the heel. Shortened calf muscles and Achilles tendon can put extreme tension on the periosteum (bone covering) attached to the heel, inflaming the periosteum and plantar fascia. The accumulation of calcium, a natural protective process, within the inflamed area over a long period of time can lead to the formation of a bone spur. The flexor digitorum brevis can also cause a bone spur on the plantar surface of the foot.

Massage therapy and stretching will help decrease calf pain caused by myofascial trigger points and restriction. These muscles should be stretched in a non-weight-bearing position. To comfortably stretch the calves, have the client lie on his back with the buttocks against the wall and the legs pointed toward the ceiling (hamstring stretch). Then instruct the client to dorsiflex the ankle. This will allow for a complete stretch of the calves, while protecting the back.

ROUTINE: Gastrocnemius, Soleus, and Plantaris

Position of client: prone. Dorsiflex the client's ankle and stabilize against the thigh.

1. Using the fingertips, treat the posterior lower-extremity compartment with slow, deep effleurage from the Achilles tendon to the ischial tuberosity, separating the muscular divisions. (See Figure 6.17.)
2. Using both thumbs, treat the calf muscles with downward compression, and light friction utilizing the edge technique. When the musculature softens (releases), move in 1-inch segments to the next contact point until the entire calf is treated. (See Figure 6.18.)



FIGURE 6.17



FIGURE 6.18

- Using fingertip compression with effleurage, trace three lines (medial, median, and lateral) up the inferior heads of the gastrocnemius. (See Figure 6.19.) This will treat the myofascia, gastrocnemius, soleus, and the deep plantar flexors of the ankle. While penetrating to a greater depth into the deeper plantar flexors of the ankle, move slowly and cautiously so that you do not overstimulate (going over the edge) and create residual soreness for the client

Use your knee as a bolster for the client's ankle.

- Isolate and “pick up” the two bellies of the gastrocnemius. (See Figure 6.20.) Treat each head separately with compression and friction in 1-inch segments. Petrissage and friction each belly of the gastrocnemius from the Achilles tendon to the popliteal fossa.

Dorsiflex the foot at 45 degrees into your chest.

- With the fingers pointing inward, treat the intermuscular septum with slow, deep effleurage while simultaneously lifting the gastrocnemius up and off the soleus muscle. Using your fingertips, treat the soleus with static compression in 1-inch segments. As the client comfortably allows, proceed into the deeper layers of the soleus. Hold each contact point throughout the soleus belly until softening or releasing occurs while maintaining the client's edge. (See Figure 6.21.)
- While sitting on the table, flex the client's knee at 90 degrees and rest it on your shoulder girdle. (See Figure 6.22.) Treat with caution as the tibial nerve (branching down from the sciatic nerve) and the popliteal artery (branching down from the femoral artery) cross the popliteal fossa behind the knee.
- Treat the plantaris muscle. First compress and then slowly cross-fiber friction the plantaris while moving from medial to lateral, throughout the popliteal fossa. (See Figure 6.23.)
- Place your elbow on the client's ischial tuberosity while tractioning the ankle toward the ceiling. This decompresses the tibial-talar and subtalar joints. (See Figure 6.24.) Friction the borders of the Achilles tendon, retinaculum, and calcaneus bone.
- Effleurage the entire posterior lower extremity.

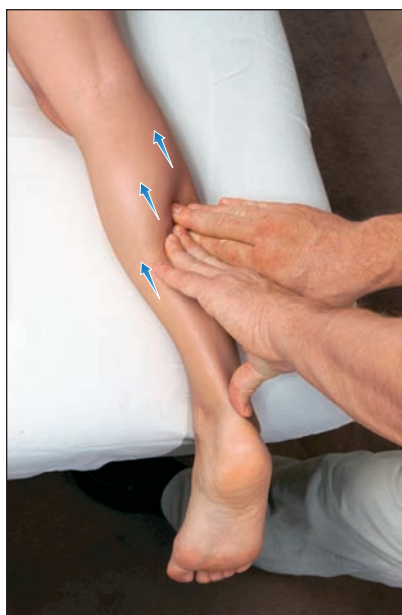


FIGURE 6.19



FIGURE 6.20

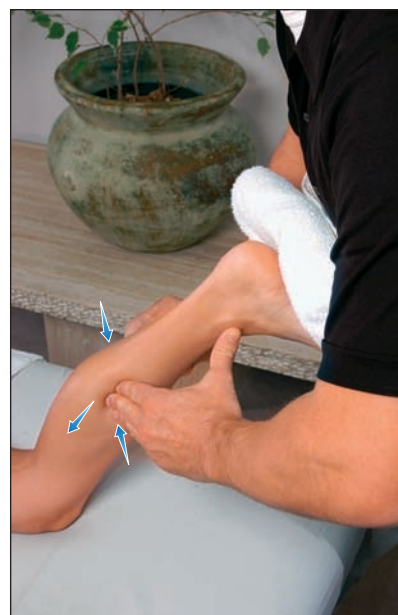


FIGURE 6.21



FIGURE 6.22

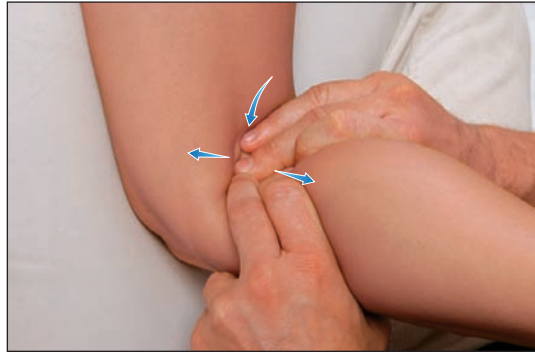


FIGURE 6.23



FIGURE 6.24

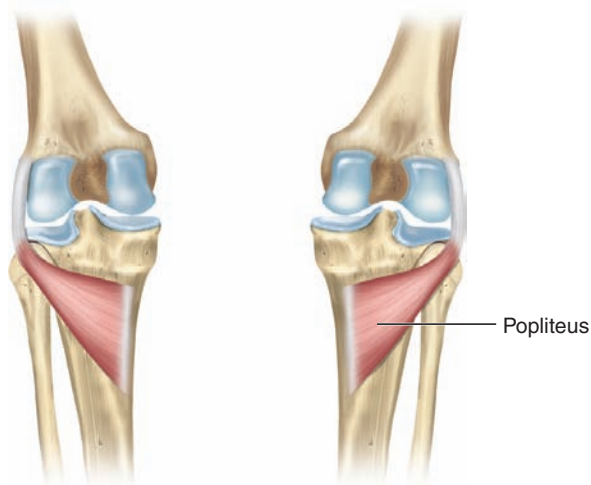
POPLITEUS, FIGURES 6.25 AND 6.26

ORIGIN Lateral condyle of femur

INSERTION Posterior proximal tibial shaft

ACTION Flexes leg; rotates leg medially

MYOTOME L4, L5, S1

FIGURE 6.25 **Popliteus Muscles**

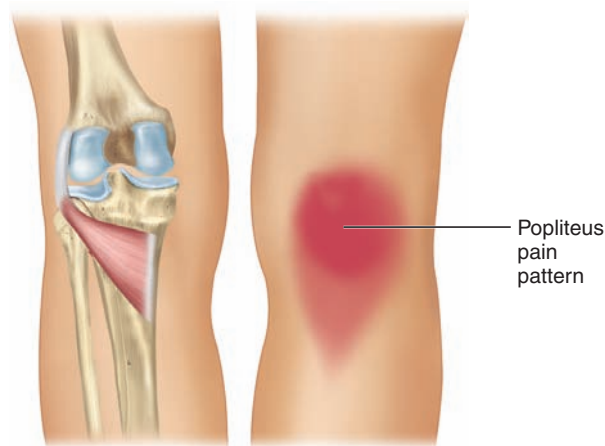


FIGURE 6.26 **Popliteus Muscle and Referred Pain Pattern**

CLINICAL NOTES: Popliteus

The popliteus muscle is very deep and small, and its belly crosses the endangerment site behind the knee. Treat it with caution, as the tibial nerve (branching down from the sciatic nerve) and the popliteal artery (branching down from the femoral artery) cross the popliteal fossa behind the knee. The popliteus muscle shares fascial attachments with the meniscus and synovial capsule of the knee.

Myofascial pain arising from the popliteus and plantaris muscles is concentrated in the popliteal fossa directly behind the knee.

Hypertonicity of the popliteus muscle can be aggravated by many weight-bearing exercises that involve forced and tension-loaded movements of the knee. Sports activities (e.g., golf, tennis, and dance) with repetitive twisting movements of the legs can facilitate improper femoral angulations, tibial torsioning, and chronic weak knees and ankles.

ROUTINE: Popliteus

Position of client: prone. While sitting on the table, flex the client's knee at 90 degrees and rest it on your shoulder girdle.

1. Prior to treating the popliteus, isolate its attachments. Remember that the popliteus muscle belly crosses the endangerment site behind the knee. (See Figure 6.27.) Use focused intent and precision when isolating and treating the popliteus muscle and throughout the popliteal fossa.
2. With fingertip compression, lightly and slowly isolate the popliteus muscle on the posterior medial tibia where it attaches 2 inches below the popliteal fossa. (See Figure 6.28.) Compress and friction this area.
3. With fingertip compression, isolate the popliteus muscle where it attaches to the lateral condyle of the femur. Compress and friction this area. (See Figure 6.29.) *Slowly rotating the knee while compressing the popliteus muscle will assist in stretching it.*
4. Very cautiously glide superiorly in 1-inch segments throughout the popliteal fossa.



FIGURE 6.27



FIGURE 6.28

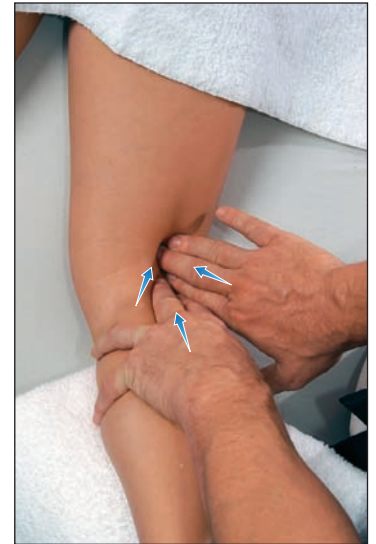
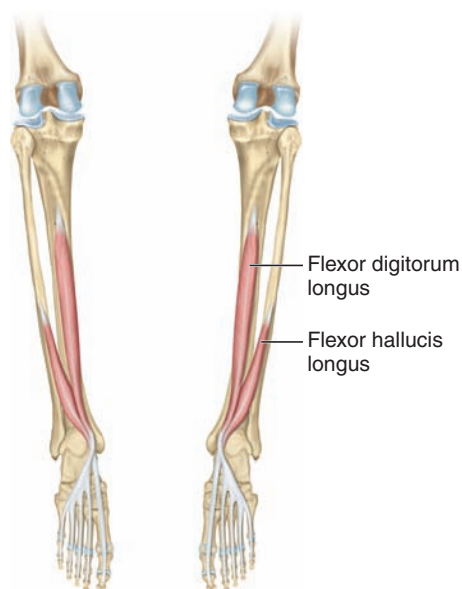


FIGURE 6.29

DEEP POSTERIOR COMPARTMENT

FLEXOR DIGITORUM LONGUS, FIGURES 6.30 AND 6.31

ORIGIN	Middle posterior tibial shaft
INSERTION	Distal phalanges of the four lateral toes (plantar surface)
ACTION	Flexes the four lateral toes; assists plantar flexion of ankle
MYOTOME	L5, S1

FIGURE 6.30 **Flexor Digitorum Longus and Flexor Hallucis Longus Muscles**

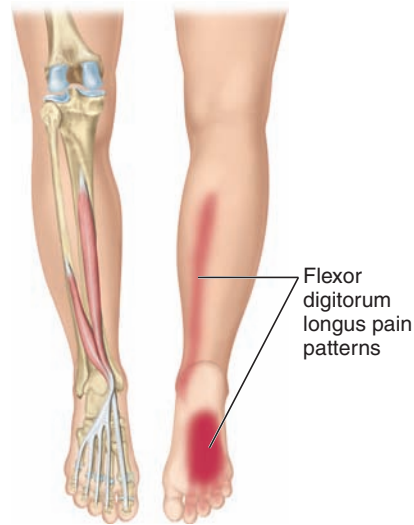


FIGURE 6.31 **Flexor Digitorum Longus Muscle and Referred Pain Pattern**

FLEXOR HALLUCIS LONGUS, FIGURES 6.30 AND 6.32

ORIGIN	Middle posterior fibular shaft
INSERTION	Distal phalanx of the great toe
ACTION	Flexes the great toe; assists plantar flexion of ankle
MYOTOME	L5, S1, S2

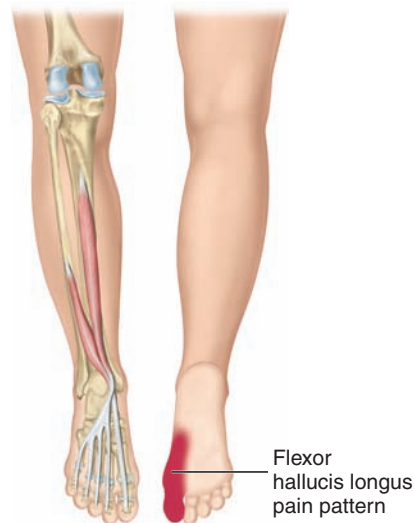


FIGURE 6.32 **Flexor Hallucis Longus Muscle and Referred Pain Pattern**

TIBIALIS POSTERIOR, FIGURES 6.33 AND 6.34

ORIGIN	Posterior tibial shaft, interosseous membrane, posterior fibular shaft
INSERTION	Plantar surface of tarsal and metatarsal bones
ACTION	Inversion of foot; assists plantar flexion of ankle
MYOTOME	L5, S1

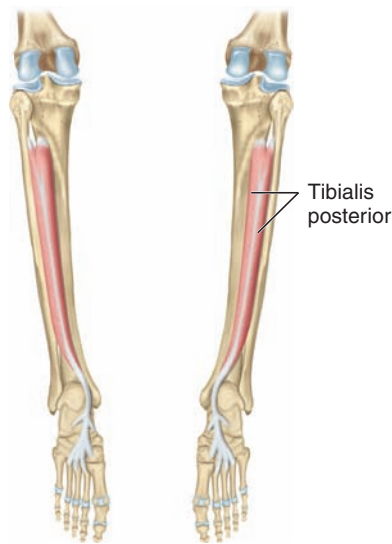


FIGURE 6.33 **Tibialis Posterior Muscles**

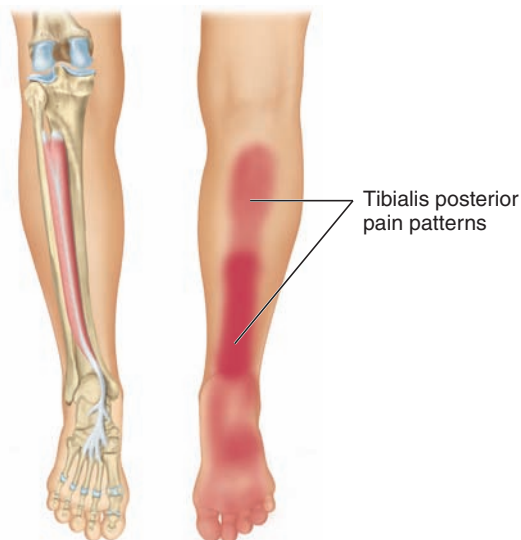


FIGURE 6.34 **Tibialis Posterior Muscle and Referred Pain Pattern**

CLINICAL NOTES: Deep Posterior Compartment

The muscles of the deep posterior compartment are best palpated from a medial approach because they are the deepest of the posterior lower leg, lying underneath the soleus and the gastrocnemius. All three muscles of the deep posterior compartment originate on the posterior proximal lower leg, travel the length of the calf, and cross the ankle posterior to the medial malleolus in the following order: tibialis posterior, flexor digitorum longus, and flexor hallucis longus (“Tom, Dick, and Harry”). All three muscles attach on the plantar surface of the foot and assist in plantar flexion of the ankle.

Each muscle in the deep posterior compartment also has an additional role. The flexor digitorum longus inserts on and flexes the lateral four toes. The flexor hallucis longus inserts on and flexes the big toe. The tibialis posterior inserts on the plantar surface of the tarsals and metatarsals and assists with inversion of the foot. As a functional unit, balance, stability, and transference of weight from heel to toe are the basic functions of the deep posterior muscles.

The tibialis posterior refers pain to the sole of the foot and Achilles tendon during ambulation. The flexor digitorum longus muscle refers pain to the middle of the dorsal foot. The accumulation of chronic excess muscle and nerve tension originates deep within the calf, but the inflammation and pain are experienced within the branching tendons that fan out distally to the lateral four toes. Pain from the flexor hallucis longus muscle refers to the big toe and the associated metatarsal-phalangeal joint. Hypertonicity of these muscles can result in sharp, persistent pain in the foot. These symptoms may become chronic if the muscles are left untreated. Symptoms are exacerbated by vigorous activities, as well as walking or running on uneven terrain and/or barefooted on hard surfaces, which can perpetuate even shorter muscle fibers and increased myofascial pain and restrict joint mobility.

These deep posterior compartment muscles cross the tibial-talar and subtalar joints of the ankle. Chronic ankle pain from residual muscular imbalance is often the result of previously sprained ankles that have gone untreated.

ROUTINE: Deep Posterior Compartment

Position of client: side-lying, with the upper leg flexed at the hip 90 degrees and bolstered. (See Figure 6.35.) This should allow adequate clearance to treat the medial aspect of the lower leg.

1. Using the fingertips, treat the medial aspect of the PLEC with slow, deep effleurage from the arch of the foot to the proximal thigh, separating the muscular divisions.
2. Isolate the medial malleolus. While performing passive range of motion to the ankle, treat the muscles and tendons around the posterior aspect of the medial malleolus with gliding, compression, and circular friction. (See Figure 6.36.)
3. Using the fingertips, glide in 1-inch segments and compress the muscular bellies. Proceed deeper while maintaining the client's edge along the posterior tibial shaft from the ankle to the knee. (See Figure 6.37.)

4. Wrap both hands around the lower leg. Using thumbs, apply deep static compression slowly to the deep posterior compartment muscles in 1-inch segments. (See Figure 6.38.)
5. Following the client's edge, continue with deeper compression while incorporating movement palpation and range of motion to the foot and ankle. This will help stretch the muscles. This is often a sensitive area if treated too aggressively, so it is important to focus on the client's subtle body reactions when applying deeper compressions to this area. Maintain the client's edge. (See Figure 6.39.) The edge technique is discussed on pages 109–112. Recall that following the client's edge is defined as before the onset of pain or client resistance. Going too deep and/or too fast will cause the client to armor or resist by tensing the body. Following the edge is a fine line between going too deep and not going deep enough. The edge involves applying slow deep pressure with no pain.
6. Using contoured palms, effleurage the entire medial lower leg and thigh.



FIGURE 6.35



FIGURE 6.36



FIGURE 6.37



FIGURE 6.38



FIGURE 6.39

HAMSTRING GROUP**SEMIMEMBRANOSUS,** FIGURES 6.40 AND 6.41

ORIGIN	Ischial tuberosity
INSERTION	Posterior medial tibial condyle
ACTION	Flexion of knee; extension of hip; medial rotation of flexed knee
MYOTOME	L5–S2

SEMITENDINOSUS, FIGURES 6.40 AND 6.41

ORIGIN	Ischial tuberosity
INSERTION	Pes anserinus—medial proximal tibial shaft
ACTION	Flexion of knee; extension of hip; medial rotation of flexed knee
MYOTOME	L5–S2

BICEPS FEMORIS, FIGURES 6.40 AND 6.42

ORIGIN	<i>Long head:</i> ischial tuberosity
	<i>Short head:</i> linea aspera and supracondylar ridge of femur
INSERTION	Head of fibula
ACTION	Extension of hip; flexion of knee; lateral rotation of flexed knee
MYOTOME	L5–S3

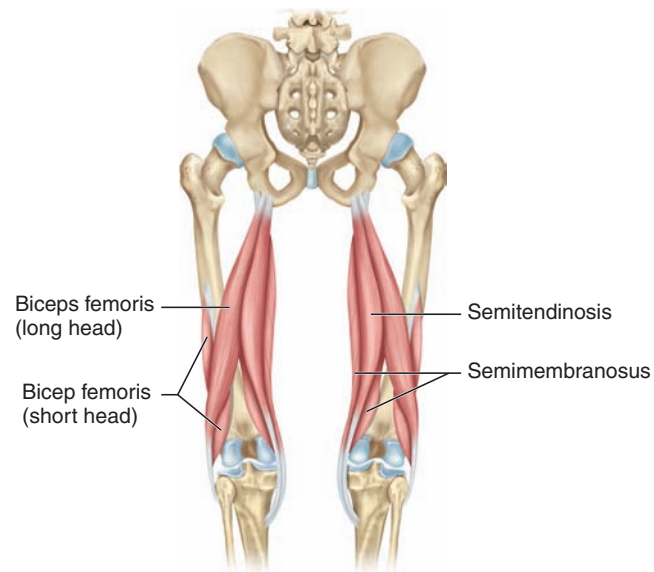


FIGURE 6.40 **Semimembranosus, Semitendinosus, and Biceps Femoris Muscles**

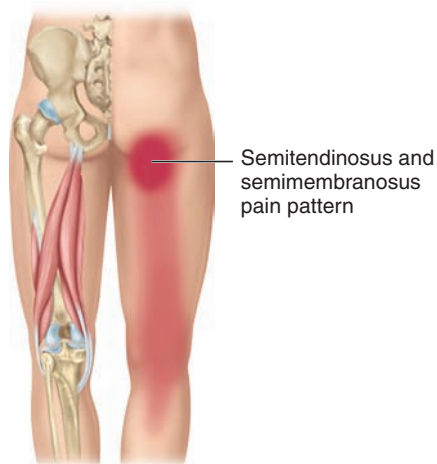


FIGURE 6.41 **Semimembranosus and Semitendinosus Muscles and Referred Pain Pattern**

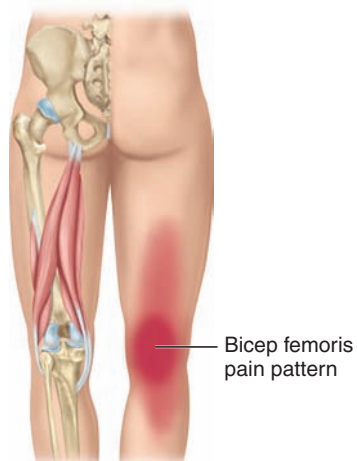


FIGURE 6.42 **Biceps Femoris Muscle and Referred Pain Pattern**

CLINICAL NOTES: Hamstring Group

The semimembranosus, semitendinosus, and biceps femoris are three muscles that make up the hamstrings. The biceps femoris and semitendinosus are the most superficial muscles of the posterior thigh. The two-headed biceps femoris makes up the lateral section, and the semitendinosus overlies the deeper semimembranosus to make up the medial section. The superficial semitendinosus is a thicker muscle proximally, while the deeper semimembranosus is a thicker muscle distally.

All the muscles in this group are two-joint muscles, with the exception of the short head of the biceps femoris, which is a one-joint muscle that acts primarily as a knee flexor. The two-joint muscles perform knee flexion (they all cross the knee joint), extension of the hip, and rotation of a flexed knee in a particular direction. The biceps femoris, positioned laterally, assists in lateral rotation. The semitendinosus and semimembranosus, positioned medially, assist in medial rotation. These two muscles work during ambulation by staying taut during the weight-bearing stance, as they counterstabilize the iliopsoas—an antagonist to the hamstrings—during hip flexion.

If chronic excess muscle and nerve tension in the hamstrings are causing problems, pain on walking and running is noticeable. Some people may even experience a limp, weakness, and limited range of motion on the affected side. When pain in the lower back is present, lengthening the hamstring muscles is crucial. The hamstrings have a direct impact on causing the pelvis to posteriorly rotate, flattening the lumbar spine and facilitating a downward stooped or collapsed posture and forward head and neck posture.

Sitting in an elevated chair with the feet dangling and inadequate leg support will put direct pressure onto the bellies of the hamstrings. This can cause myofascial trigger points in these muscles. Certain occupations, such as dental hygienist, put strain on a person's body. The practitioner is seated in a forward and twisted position for much of the day, causing the abdominal musculature to adaptively shorten, and this can stimulate a shortening effect in the hamstring muscles and gluteals. Shortened hamstrings can even be a result of sitting comfortably for long hours, which can also lead to a downward stooped, collapsed posture.

When the hamstrings adaptively shorten, they pull on their attachment at the ischial tuberosity, which rotates the pelvis posteriorly. A normal range of pelvic tilt is approximately 10 degrees from the anterior superior iliac spine (ASIS) to the posterior superior iliac spine (PSIS). A decrease from 10 degrees will be noted with a posteriorly rotated pelvis. This discrepancy can be palpated and viewed by placing one index finger on the tip of the ASIS and the other index finger on the tip of the same-side PSIS. Point each index finger toward the other, and picture an imaginary line connecting the two index fingers. This line will provide an adequate reading of the degree of tilt.

Now measure both sides and compare them. If the hamstrings are tighter on one side, the pelvis will be posteriorly rotated on that side. This results in a functional leg-length discrepancy. The short-leg side will have chronic muscle tension and shortened hip extensor muscles, whereas the long-leg side will have chronic muscle tension and shortened hip flexor muscles.

Deviations in leg lengths will result in uneven weight distribution, with the majority of the body weight shifting to the posteriorly rotated side (the short leg). This can facilitate pelvic distortion and scoliosis of the spine, producing disk compression and inflammation of the vertebral and sacroiliac joints. Lumbosacral sprain and strain injuries of the sacral ligaments and lower-back muscles are common in people with shortened hamstrings. If pain is persistent and chronic, it is good practice to refer the client to a medical specialist.

When pain, tension, or restriction in this area is present, it is necessary to determine the cause of the problem before implementing treatment. Do not chase the pain. A painful area may be a warning signal that muscle fibers are lengthening and tired of opposing the stronger side. Weight training would then be indicated to restore strength to the weakened muscles once the chronic excess muscle and nerve tension on the shortened side has been sufficiently decreased or eliminated. Most often, once the muscles are balanced, the pain diminishes and strength to the opposing muscles is restored.

To determine which side is shortened, and therefore the side to treat, use palpatory skills, assess the degree of pelvic rotation, and administer a straight leg stretch exam to each leg in a nonweight supine position. Do this by grasping under the ankle with one hand and supporting under the knee with the other. Keep the client's leg fixed in a straight position, lift the leg off the table (ankle toward the ceiling), and evaluate how far each of the hamstrings can stretch before resistance is experienced. The tighter side will have less range and more resistance.

Always treat the hamstring muscles when a loss of lumbar curve (military lumbar spine) and a posteriorly rotated pelvis are noted. This procedure can be time-consuming, depending on the size of the client's legs, the extent of the hypertonicity, and the ischemic condition of the muscles. The therapist must keep her body in correct postural alignment so that treatment is delivered efficiently and effectively.

Stretching the hamstring, gluteal, and abdominal muscles will help combat the downward stooped, collapsed posture often experienced by a seated-chair pain client. To comfortably stretch the hamstrings, have the client lie on the back with the buttocks against the wall and the legs pointed toward the ceiling and flush against the wall. Gravity can aid in this stretch. Spreading the legs in this position will also stretch the adductor muscles, while protecting the back.

ROUTINE: Hamstring Group

Position of client: prone.

1. Using the fingertips, treat the posterior lower-extremity compartment with slow, deep effleurage from the Achilles tendon to the ischial tuberosity, separating the muscular divisions. (See Figure 6.43.)
2. While sitting on the table, flex the client's knee at 90 degrees and rest it on your shoulder girdle. (See Figure 6.44.)
3. Beginning superior to the popliteal fossa, use both hands to stretch the myofascia, moving superiorly and outward (medial or lateral) with each hand. (See Figure 6.45.)
4. Using the fingertips, glide in a superior direction, separating the muscular divisions of the hamstrings. (See Figure 6.46.) Using angulating fingers, trace three lines (medial, median, and lateral) superiorly, first superficially and then deeper into the intermuscular septum.
5. Have the client move inferiorly and hang the feet off the table, which will put the hamstrings in a lengthened position. (See Figure 6.47.)
6. Using the elbow or forearm, treat the hamstrings with compression in 1-inch segments from above the popliteal fossa to the ischial tuberosity. Utilize the edge technique. (See Figure 6.48.) As the client allows (via verbal communication), proceed deeper until you have achieved a substantial release and softening of the muscles and fascia.
7. Using the knee, continue a deeper compression while maintaining the client's edge. Using the knee will enable deeper penetration into the muscle that would not be reached using the elbow or forearm. The knee provides broader and deeper compression to the muscles. (See Figure 6.49.)
8. Using the sole of the foot is extremely effective and efficient for releasing the deeper levels of tension within the hamstring muscles. (See Figure 6.50.) It takes a conscious and focused approach to administer this technique. To maintain the client's comfort zone, balancing your body weight is the key. A bar anchored to the ceiling above the therapy table is an ideal apparatus and serves as an excellent supporting device as you move on and off the client's hamstrings with little effort. This technique takes practice, but in time it will be one of the most effective ways to deliver deeper and broader compression to the hamstring muscle group.
9. Using the hands and forearms, treat the hamstrings with deep, slow effleurage 6 to 8 times, always stroking toward the heart. This will assist in venous return and decrease the metabolic waste accumulation in the leg.



FIGURE 6.43



FIGURE 6.44



FIGURE 6.45



FIGURE 6.46



FIGURE 6.47

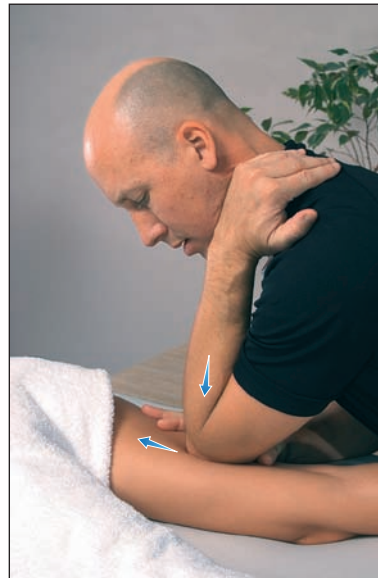


FIGURE 6.48



FIGURE 6.49

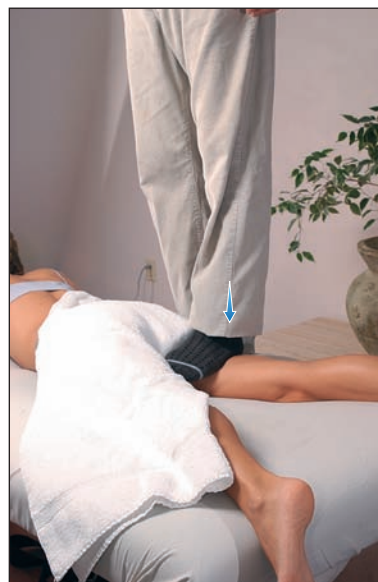


FIGURE 6.50

GLUTEUS MAXIMUS, FIGURES 6.51 AND 6.52

ORIGIN Posterior sacrum, ilium

INSERTION Gluteal tuberosity of femur and iliotibial tract to lateral condyle of tibia

ACTION Extends and laterally rotates hip; extends trunk

MYOTOME L5–S2

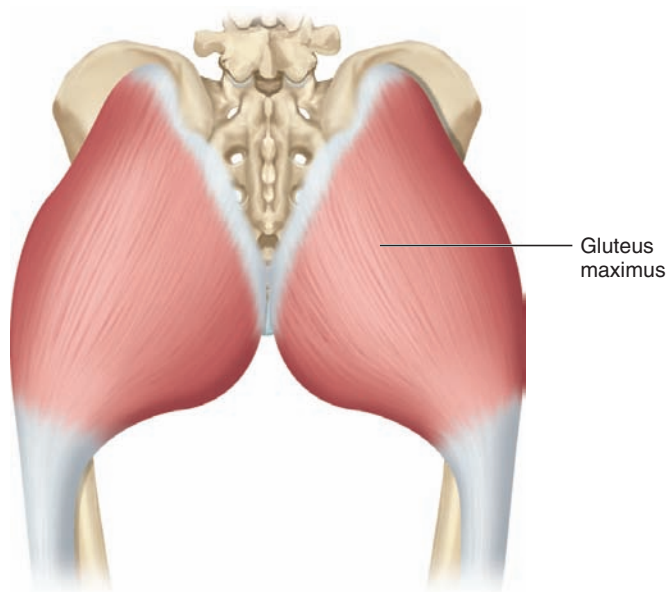


FIGURE 6.51 **Gluteus Maximus Muscles**

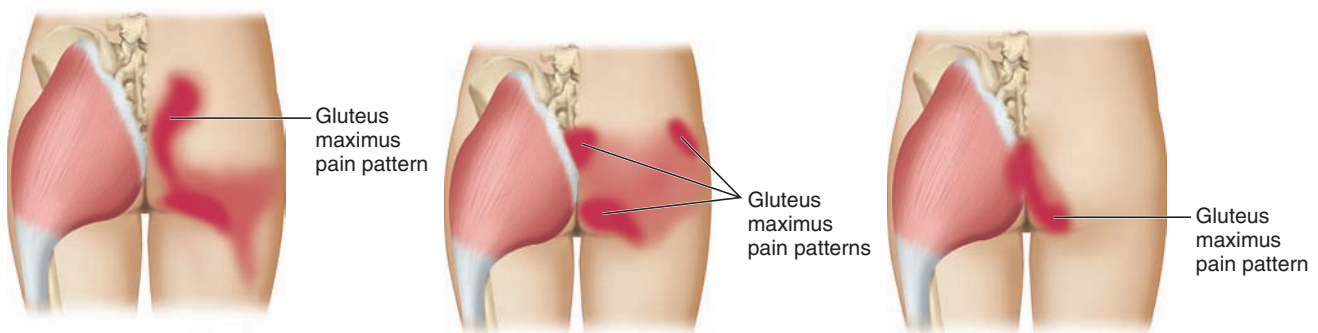


FIGURE 6.52 **Gluteus Maximus Muscle and Referred Pain Patterns**

CLINICAL NOTES: Gluteus Maximus

The gluteus maximus is the most superficial and powerful of the hip extensors. It originates on the sacrum, and posterior iliac crest; covers the lower portion of the sacroiliac joint and the ischial tuberosity where the hamstrings attach; and merges with the longitudinal fascia of the iliotibial band.

The gluteus maximus and adductor magnus act as a functional unit during strenuous or forced hip extension movements, such as kicking the legs when swimming. The gluteus maximus and hamstrings also work during ambulation, as they counterstabilize the iliopsoas and rectus femoris muscles during hip flexion.

The gluteus maximus, quadratus lumborum, erector spinae, and musculature deep in the lamina groove (multifidus and rotatores) all have similar pain referrals and should be routinely examined when buttock pain is present.

Both gluteus maximus muscles should be treated with all buttock, low-back, hip, and posterior upper-thigh pain. Leg-length deviations, sacroiliac dysfunction, and hip problems can be attributed to these muscles.

If pain is persistent and chronic, it is good practice to refer the client to a medical specialist to rule out nerve compression arising from a bulging or fractured disk of the lower lumbar spine.

ROUTINE: Gluteus Maximus

Position of client: prone, with ankles and feet hanging off the table.

1. Using the fingertips, treat the PLEC with slow, deep effleurage from the Achilles tendon to the sacrum and superior iliac crest, separating the muscular divisions. (See Figure 6.53.)
2. Using the fingertips or thumbs, treat the gluteal fascia and muscles attaching on the sacrum, iliac crest, and posterior ilium to the ASIS with static compression and cross-fiber friction. (See Figure 6.54.)
3. Using the fingertips, palms, and/or elbows, glide slowly and deeply from the sacroiliac bones to the greater trochanter of the femur.

Flex the client's knee, and laterally rotate the leg at the hip at a 45-degree angle.

4. Isolate the gluteus maximus where it merges into the iliotibial band (ITB), approximately 4 inches below the gluteal fold. Using contoured palms, treat with slow, deep effleurage and friction. (See Figure 6.55.)
5. Using the fingertips, treat the muscular divisions between the hamstrings and the ITB. (See Figure 6.56.) Using the fingertips, treat the muscular divisions that separate the gluteus medius and gluteus minimus from the gluteus maximus.
6. Effleurage the entire posterior lower-extremity compartment from the heel to the iliac crest.



FIGURE 6.53



FIGURE 6.54



FIGURE 6.55



FIGURE 6.56

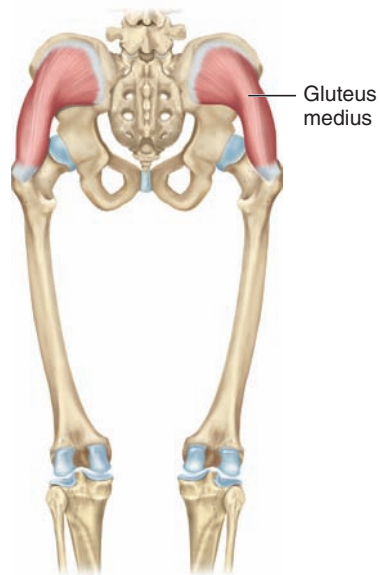
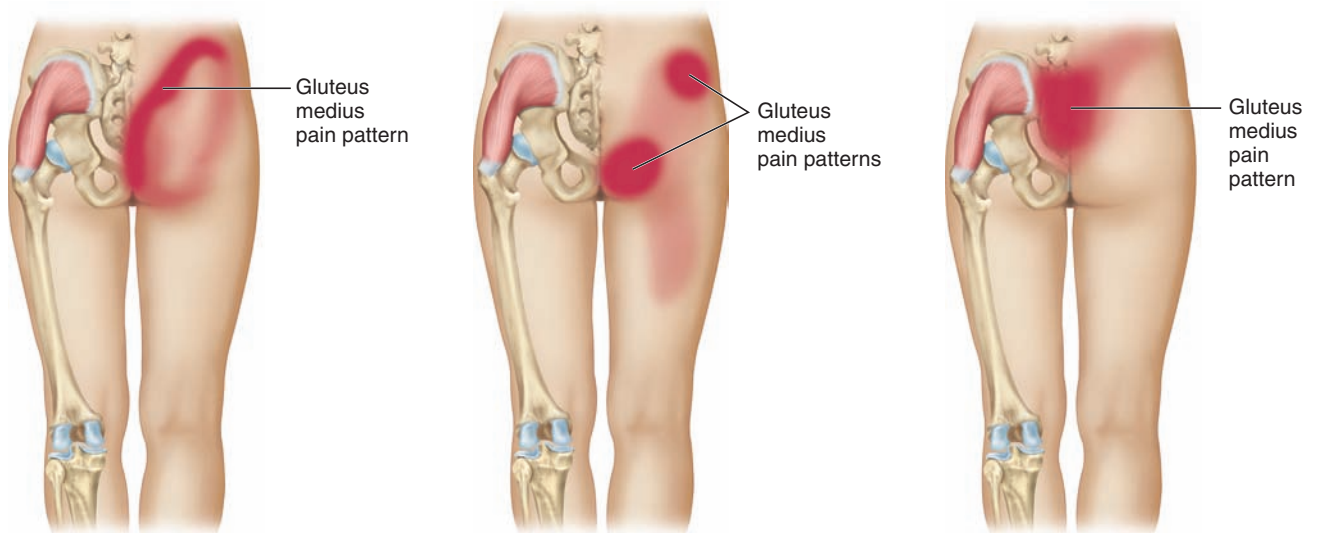
GLUTEUS MEDIUS, FIGURES 6.57 AND 6.58

ORIGIN Posterior iliac crest

INSERTION Greater trochanter of femur

ACTION Abducts the leg at the hip; medially rotates the thigh

MYOTOME L4–S1

FIGURE 6.57 **Gluteus Medius Muscles**FIGURE 6.58 **Gluteus Medius Muscle and Referred Pain Patterns**

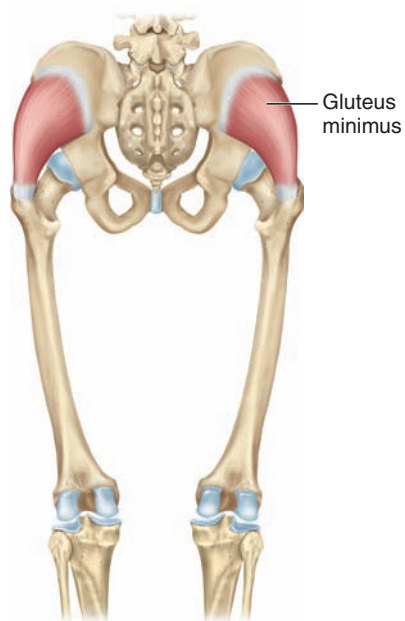
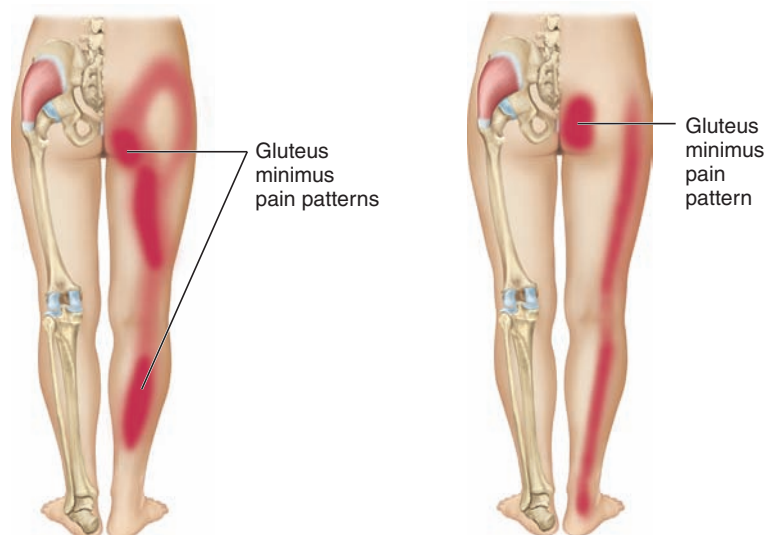
GLUTEUS MINIMUS, FIGURES 6.59 AND 6.60

ORIGIN Approximately 1 inch below posterior iliac crest on ilium

INSERTION Greater trochanter of femur

ACTION Abduction of thigh at hip; medially rotates thigh

MYOTOME L4–S1

FIGURE 6.59 **Gluteus Minimus Muscles**FIGURE 6.60 **Gluteus Minimus Muscle and Referred Pain Patterns****CLINICAL NOTES:** Gluteus Medius and Minimus

The gluteus medius and gluteus minimus muscles are the most lateral muscles of the hip.

The gluteus medius is one muscle with anterior and posterior divisions. Both divisions originate on the posterior iliac crest and crisscross each other on their separate paths to the greater trochanter.

The anterior portion of the gluteus medius is covered only by fascia, whereas the posterior one-third of the gluteus medius is covered by the gluteus maximus: the largest, strongest, and most superficial muscle of the buttock. The gluteus minimus is smaller, deeper, and inferior to the gluteus medius, but it shares similar attachment sites and functions.

The primary function of the gluteus medius and gluteus minimus is abduction of the leg at the hip joint, assisted by the tensor fasciae latae. A secondary function of these muscles is medial rotation of the leg. The gluteus medius and gluteus minimus also act as a functional unit in maintaining a level pelvis, and they stabilize the hip joints during ambulation and lateral weight-shifting movements.

Though these two muscles share common attachment sites and functions, the pain patterns of each can be very different. The gluteus medius is a very common source of lower-back pain. This muscle also refers pain to the sacrum, sacroiliac joint, buttock, and hip joint, but the pain very rarely travels below the gluteal fold. This pattern is typical of the lumbosacral muscles, including the gluteus maximus and the quadratus lumborum.

Unlike the local pain of the gluteus medius, gluteus minimus pain is referred down the posterior lateral thigh, extending to the calf and lateral ankle. These symptoms are known as *sciatica*. *Note:* Sciatica is not a diagnosis. In mainstream medicine, it is assumed that sciatica stems from pathologies of the lumbar disks and/or articular dysfunction of the lumbar and sacroiliac joints. Since the gluteus minimus and piriformis muscles trigger pain referrals similar to that of lumbar nerve root irritation, they should be treated whenever sciatica symptoms are present.

Hypertonic gluteus medius and minimus muscles will laterally tilt the pelvis, affecting the horizontal plane and shifting a person's body weight to the opposite, short leg.

Treat these muscles on the long-leg side to help stabilize the pelvis and decrease back pain and symptoms of sciatica. If the frequency and intensity of pain persists, the client should be referred to a primary care physician for a full medical and diagnostic evaluation to determine the underlying cause.

ROUTINE: Gluteus Medius and Minimus

Position of client: side-lying, with the upper leg extended at the hip and bolstered and the ankle and foot hanging off the therapy table. The client's lower leg should be flexed at the hip and knee (jackknifed) to provide stability. (See Figure 6.61.)

While treating the muscles of the hip, periodically change the angles of the legs. This will expose and stretch the myofascia.

1. Using the fingertips, treat the lateral thigh with slow, deep effleurage, separating the muscular divisions. (See Figure 6.62.)
2. Isolate the greater trochanter. Using the thumbs, treat the superior border in all directions. (See Figure 6.63.)

3. Palpate the gluteus medius and minimus along the iliac crest. With fingers or thumbs, treat with static compression and friction in 1-inch segments. (See Figure 6.64.)
4. Using the fingertips, glide and friction the muscular divisions of the gluteus medius and gluteus minimus between the TFL and piriformis muscles. (See Figure 6.65.)
5. Using the back of the hand, effleurage the gluteal muscle bellies between the iliac crest and the greater trochanter. Treat vertically in both directions. (See Figure 6.66.)



FIGURE 6.61

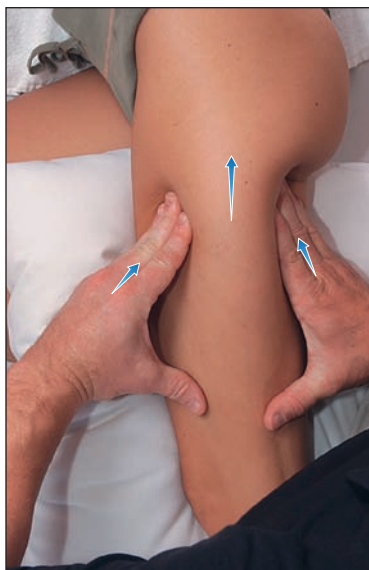


FIGURE 6.62



FIGURE 6.63



FIGURE 6.64

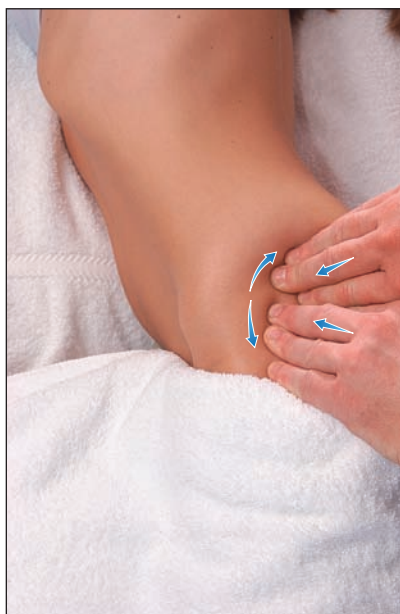


FIGURE 6.65



FIGURE 6.66

LATERAL HIP ROTATORS

PIRIFORMIS, FIGURES 6.67 AND 6.68

ORIGIN	Anterior sacrum
INSERTION	Greater trochanter of femur
ACTION	Laterally rotates thigh at hip; abducts thigh
MYOTOME	S1, S2

OBTURATOR EXTERNUS, FIGURES 6.67 AND 6.68

ORIGIN	Ischium, obturator foramen
INSERTION	Greater trochanter of femur
ACTION	Laterally rotates thigh at hip
MYOTOME	L3, L4

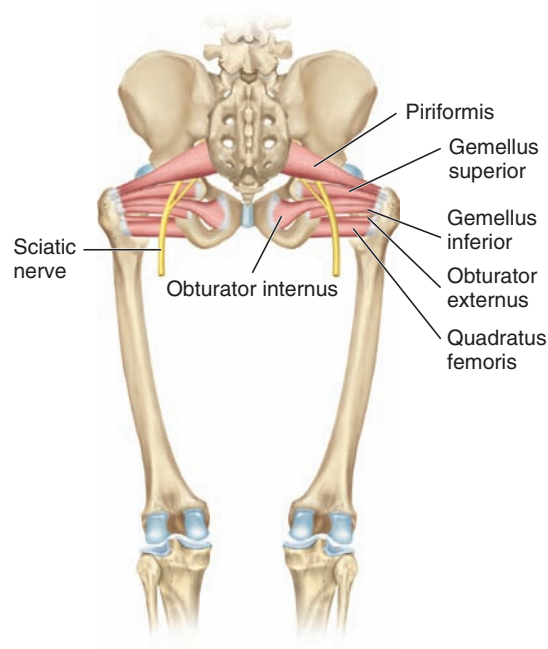


FIGURE 6.67 **Lateral Hip Rotator Muscles**

QUADRATUS FEMORIS, FIGURES 6.67 AND 6.68

ORIGIN	Lateral border of ischial tuberosity
INSERTION	Greater trochanter of femur
ACTION	Laterally rotates thigh at hip
MYOTOME	L5–S1

GEMELLUS SUPERIOR, FIGURES 6.67 AND 6.68

ORIGIN	Spine of ischium
INSERTION	Greater trochanter of femur
ACTION	Laterally rotates thigh at hip
MYOTOME	L5–S3

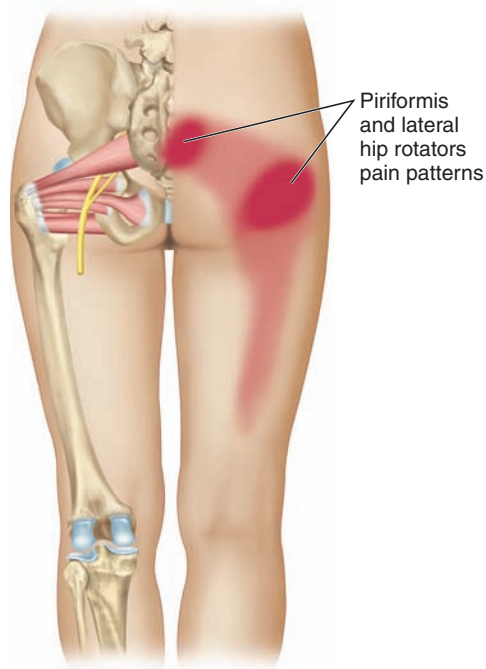


FIGURE 6.68 **Lateral Hip Rotator Muscles and Referred Pain Pattern**

OBTURATOR INTERNUS, FIGURES 6.67 AND 6.68

ORIGIN	Ischium, obturator foramen
INSERTION	Greater trochanter of femur
ACTION	Laterally rotates thigh at hip
MYOTOME	L5–S3

GEMELLUS INFERIOR, FIGURES 6.67 AND 6.68

ORIGIN	Ischium, obturator foramen
INSERTION	Greater trochanter of femur
ACTION	Laterally rotates thigh at hip
MYOTOME	L5–S1

CLINICAL NOTES: Lateral Hip Rotators

The largest of the lateral hip rotators is the piriformis muscle. It originates on the anterior sacrum, travels through the sciatic notch of the ilium, and inserts on the greater trochanter. The piriformis muscle separates the gluteus medius and minimus muscles above from the remaining five deep lateral hip rotators below. The remaining deep lateral hip rotators lie between the piriformis and the gluteal fold. They fan out from their varied attachments on the ischium to the lateral insertions on the greater trochanter.

The acetabular femoral joints (hip joints) are true ball-and-socket joints. The head of the femur inserts deeply into the hip socket on the pelvis. The neck of the femur extends outward from the socket to provide clearance for leg movement. This clearance allows a wide range of motion, similar to movements of the shoulder joint.

The deep lateral hip rotators do just that: laterally rotate the hip. Additionally, the piriformis muscle assists the adjacent gluteus medius and minimus in abduction when the leg is flexed 90 degrees at the hip. The piriformis and lateral hip rotator muscles are stabilizers of the hip joints during weight-bearing activities, countering the tension of the medial rotators.

The deep lateral hip rotators refer pain to the hip and buttock region and should be treated as a functional unit when buttock and hip pain is present, especially when medial rotation of the leg is restricted.

A hypertonic piriformis can entrap or compress the sciatic nerve against the pelvic bone (sciatic notch). This can cause a persistent and sharp radiating pain that travels down the posterior lateral thigh, commonly extending to the calf and foot. If the frequency and intensity of pain persists, the client should be referred to a primary care physician for a full medical and diagnostic evaluation to determine the underlying cause.

The hip muscles support and stabilize the pelvic girdle. They help maintain horizontal symmetry of the pelvis. Muscular and skeletal symmetry of the pelvis is directly related to proper spinal alignment and postural efficiency. Muscular imbalance and/or scoliosis can create a deviation in leg lengths. This will result in uneven weight distribution on the legs, with more wear and tear on the short leg. Myofascial pain and hip compression are common on the short-leg side. Without treatment, this type of distortion can lead to degenerative arthritis.

A person suffering from lower-back and gluteal pain should sleep on the unaffected side with a pillow between the knees. This will keep the hips in a neutral position and avoid painful stretching of the lateral hip rotators and gluteal muscles. For complete and lasting relief of this pain, a home stretching program is essential.

ROUTINE: Lateral Hip Rotators

Position of client: side-lying, with the upper leg flexed forward and medially rotated. The client's lower leg should be extended to provide stability. (See Figure 6.69.)

Penetration of the deep lateral hip rotators is done slowly and precisely. Be aware that the sciatic nerve exits at the sciatic notch and travels downward, deep within the lateral hip. If the client experiences a sharp electrical pain when you are working in this area, you may have penetrated the sciatic nerve. Slightly reposition your hands and continue treatment.

1. Using the fingertips, treat the lateral thigh and hip with slow, deep effleurage, separating the muscular divisions. (See Figure 6.70.)
2. Isolate the greater trochanter. Using the thumbs or fingers, treat the medial and posterior borders of the lateral hip rotators in all directions. (See Figure 6.71.)
3. With one hand, lift and support the leg at the ankle, flexing the client's knee. Rotate this leg medially and laterally while simultaneously treating the deep lateral hip rotators with the other hand. (See Figure 6.72.) Using the fingertips or elbow, treat slowly and cautiously with compression and friction. This technique is called *movement palpation*.

4. Gently position the elbow just below the iliac crest. Treat with gliding effleurage, moving toward the greater trochanter. (See Figure 6.73.)
5. Continue rotating the leg with one hand. Contour the other hand around the greater trochanter. Treat with a palm-rocking technique (moving compression) with the intention of affecting the muscle bellies of the deep lateral hip rotators. (See Figure 6.74.)



FIGURE 6.69



FIGURE 6.70

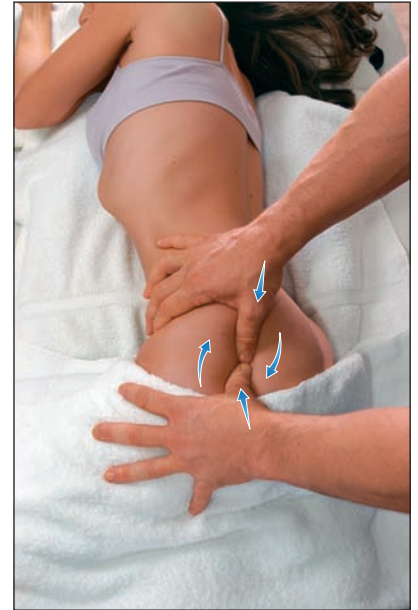


FIGURE 6.71



FIGURE 6.72

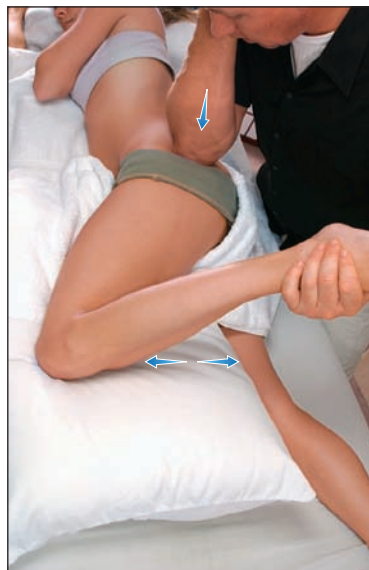


FIGURE 6.73

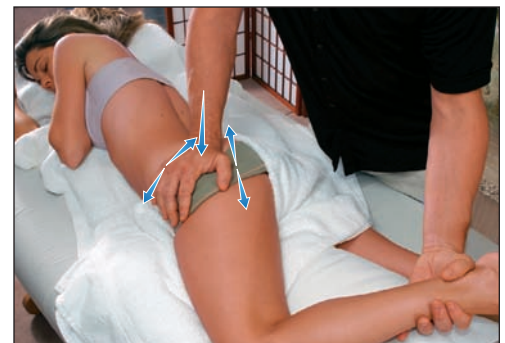


FIGURE 6.74

STRETCHING

While sitting with the knee flexed, the client grasps the sole of the foot and pulls it toward the knee. (See Figure 6.75.)



FIGURE 6.75 Foot and calf stretch

While sitting with the knee flexed, the client grasps toes 2 to 5 and pulls them toward the knee. (See Figure 6.76.)



FIGURE 6.76 Toe flexor and calf stretch

While sitting with the knee flexed, the client grasps the great toe (1) and pulls it toward the knee. (See Figure 6.77.)



FIGURE 6.77 Great-toe flexor and calf stretch

While lying on the back, the client positions the rope in the arch of the foot and elevates the leg, flexing the hip. The client positions the arms out, holding the rope, and then pulls the rope to comfortably lengthen the hamstring and calf muscles. (See Figure 6.78.)

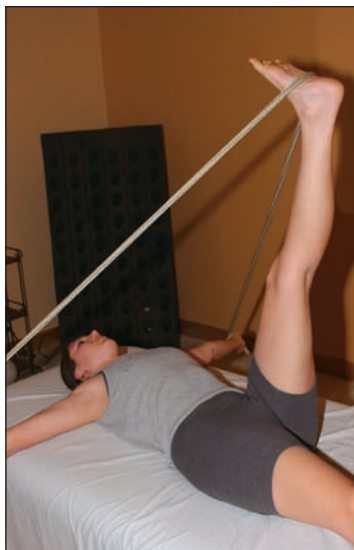


FIGURE 6.78 Posterior lower-extremity stretch with rope

While lying on the back, the client positions the rope in the arch of the foot and elevates the leg, flexing the hip. The client positions the arms out, holding the rope; then the client pulls the rope to comfortably lengthen the hamstring and calf muscles but now dorsiflexes the ankle to further stretch the muscles of the entire PLEC. (See Figure 6.79.)



FIGURE 6.79 Posterior lower-extremity stretch: dorsiflexing foot with rope

While lying on the back with the legs flush against the wall, the client relaxes into a comfortable lengthening stretch of the PLEC. (See Figure 6.80.)



FIGURE 6.80 Relaxed posterior lower-extremity stretch against a wall

While lying on the back with the legs flush against the wall, the client relaxes into a comfortable lengthening stretch of the PLEC but now dorsiflexes the ankle with a rope to further stretch the entire PLEC. (See Figure 6.81.)



FIGURE 6.81 Relaxed posterior lower-extremity stretch: dorsiflexing foot with rope against the wall

While lying on the back, the client uses two hands to grasp the heel and pull the foot toward the floor; this stretches the gluteus maximus. (See Figure 6.82.)



FIGURE 6.82 Relaxed gluteal stretch against a wall

While the client is lying on the back, anchor the lengthened leg with a seat belt; then grasp the heel with the lower hand while supporting the knee with the upper hand, and push the knee to the chest to assist with stretching the gluteus maximus. (See Figure 6.83.)



FIGURE 6.83 Assisted gluteal stretch (anchored with seat belt)

While the client is lying on the back, anchor the lengthened leg with a seat belt; then assist the client by supporting her joints while further stretching the entire PLEC. Assist with dorsiflexing the ankle to further stretch the PLEC. (See Figure 6.84.)



FIGURE 6.84 Assisted posterior lower-extremity stretch

While the client is lying on the back, anchor the lengthened leg with a seat belt; then assist the client by supporting her joints while further stretching the entire PLEC. (See Figure 6.85.)



FIGURE 6.85 Assisted posterior lower-extremity stretch: dorsiflexing foot

While the client is lying on the back, anchor the pelvis with a seat belt; place a cushioned towel as a barrier between the seat belt and the body for added client comfort. Adduct the knee toward the body's midline, stretching the gluteus medius, the gluteus minimus, and the lateral hip rotators. (See Figure 6.86.)



FIGURE 6.86 Assisted hip abductor stretch (anchored with seat belt)

While the client is lying on the back, anchor the pelvis with a seat belt; place a cushioned towel as a barrier between the seat belt and the body for added client comfort. Adduct the entire leg toward the body's midline, further stretching the gluteus medius, the gluteus minimus, the TFL, and the lateral hip rotators. (See Figure 6.87.)



FIGURE 6.87 Assisted hip adductor stretch (anchored with seat belt)

BRIEF SUMMARY

The posterior lower-extremity compartment (PLEC) is a chain of connecting muscles and fascia that arise from the plantar surface of the foot and travel upward, attaching to the iliac crest of the pelvic bone. Postural distortions arise from muscular imbalances affecting many joints of the foot, ankle, knee, hip, pelvis, and vertebral column. Treatment to the PLEC is delivered in sequence, with treatments starting at the foot and ankle and proceeding to the calf, on to the posterior and inner thigh, and up into the buttock.

The Clinical Notes boxes in this chapter cover muscular imbalances that affect posture and pain. The Routine boxes and their illustrations provide guidance for proper hand placement in delivering effective therapy techniques. The Stretching box demonstrates specific stretching techniques that are safe, effective, and easy to do.

REVIEW QUESTIONS

1. Name the primary plantar flexor of the ankle that causes heel pain associated with a condition known as plantar fasciitis.

2. Name the muscle that refers trigger point pain to the arch of the foot.

3. Where is the endangerment site located on the posterior leg?

4. Name the three muscles that form the Achilles tendon.

5. The biceps femoris muscle has two distinct heads: the long head and the short head. The long head crosses two joints and assists what two actions at the hip and knee joint?

6. Name the muscle located in the popliteal fossa that “unlocks” the knee when a torsion injury restricts full extension of the leg at the knee joint.

7. Name the large, powerful muscle group of the posterior thigh that has the ability to pull down on the pelvis, rotating it posteriorly, and can cause flattening of the lumbar spine.

8. The hamstring muscle group originates on what bony landmark?

9. What muscle is the most powerful hip extensor?

10. What muscle refers a pseudo-sciatic pain down the leg?

CRITICAL-THINKING QUESTIONS

A client complains of an acute onset of heel pain in the morning on walking. The client also complains of unusual tightness and cramping of the left calf muscles.

1. What primary muscle could elicit a direct pain referral to the heel?

2. Lengthening which large muscle group would assist the calf muscles in reducing stress to the plantar fascia?



CHAPTER 7
ANTERIOR TORSO COMPARTMENT
(ATC)

LEARNING OUTCOMES

After completing this chapter, you will be able to:

- 7.1 Define the origins and insertions of the muscles of the ATC.
- 7.2 Describe the actions of the ATC.
- 7.3 Recognize the pain patterns of the ATC.
- 7.4 Discuss the clinical notes for and the importance of treating the muscles of the ATC.
- 7.5 Demonstrate the client positioning and treatment routines related to the ATC
- 7.6 Demonstrate safe and effective stretching techniques for the muscles of the ATC.

OVERVIEW

Like the posterior lower extremity compartment (PLEC), the anterior torso compartment (ATC) includes muscles that pull the rib cage down, flatten the lumbar spine, compress the lumbar and cervical disks, and entail many muscular imbalances that cause stooped posture and pain.

Shortened abdominal muscles will pull the rib cage down and cause a forward neck and head positioning (FHP). Often, this downward collapsed, “stooped” posture will reverse the cervical curvature of the spine and compress the lower cervical disks and suboccipital joints, subsequently decreasing cervical range of motion and many back, shoulder, and upper-extremity pain syndromes. The extensors of the lumbar and cervical spine and the retractor muscles of the scapulae often are tighter, produce the most trigger points, and elicit the most pain. It is these posterior compartment muscles that countertighten and resist the forward and downward pulls of tension from the shortened trunk flexors and hip extensors. (An analogy: A tree is held up with guide wires and the tree bends to one side from sustained winds—it is the lengthened wires that become tighter as they resist the weight of the tree being pulled over by the wind.) The abdominals, psoas, serratus anterior, pectorals, and anterior cervicals are a kinetic chain that, when short, often causes chronic pain of the low back, neck, and shoulders. Often, chronic back, neck, and shoulder pain associated with muscular imbalances that effect stooped posture can be reduced and even eliminated with treatment to the short muscles in the anterior torso, rather than the painful ones often experienced in the posterior torso. Lengthening the abdominals will create space between the pelvis and the rib cage. Lengthening the serratus anterior and pectorals will create space between the shoulder girdles and the pelvis, thereby allowing the scapulae to drift up and back, restoring the body to a more upright posture. Treatment for stooped posture and forward neck and head positioning should consist of combining both the abdominals and the hamstrings within each session. Lengthening the hamstrings will cause the pelvis to rotate up and forward, increasing the lumbar curve and thereby greatly reducing the compression effect on the lumbar spinal disks. The combined treatments (ATC and PLEC) will restore the body to an upright posture, thereby decreasing the chronic pain that is often experienced in the posterior torso.

Note: The anterior torso is the emotional cylinder of the body. Playing the edge with precision and focused intent will allow the client to stay relaxed and allow you to have deeper access into the deeper layers of the abdominal wall.

Precise hand placements and treatment routines of the abdominal, chest, and anterior cervical muscles are clearly covered in this chapter to teach students how to work in these sensitive and emotional areas. The ATC therapy routines show students how to develop their skills and will help students become proficient when working with clients whose back and neck pain is the result of muscular imbalances and stooped posture.

CLINICAL SUCCESS

In 2001, a professional golfer on the PGA tour went to a therapist. He complained of a “slight numbness in his fingers with a considerable amount of decreased grip strength of his hands.” Over the course of 3 years, this client had seen numerous health care specialists and been told that he probably had a “neck stinger.” The therapist believed that the man’s complaint was the result of cervical disk compression, irritating the nerve roots at the C4 through C7 levels, as well as entrapment of the nerve supply exiting the soft tissues of his anterior and lateral neck.

During a soft-look evaluation of the client’s body, the therapist observed his projected forward head posture and suboccipital compression at the base of the occiput. He was a right-handed golfer and displayed a dropped right shoulder girdle and a locked short abdominal wall. He also had a significant number of muscular imbalances throughout his body. His primary complaints related to tingling, numbness, and weak grip strength; however, to achieve lasting results, it was necessary to address the imbalances that affected his overall posture.

The client was placed in the supine position on the table and a hard-look evaluation of his body was conducted. After thoroughly examining for lower-body deviations, the therapist concluded that the client’s leg lengths and pelvic bones were symmetrical and that his primary complaint of bilateral upper-extremity numbness and weakness was most likely isolated in the neck and the thoracic outlet. The client was moved into a side-lying position aided by a cushioned body support system. The treatment plan consisted of releasing the anterior cervical muscles, primarily the longus colli, the longus capitis, and the scalene muscles. Releasing these muscles would help restore much of his cervical lordosis, thereby reducing the compression effect on his spinal nerves and at the base of the occiput.

The muscles attached on the anterior tubercles were isolated, and the therapist proceeded to apply slow, deep compression to the scalene muscles; this triggered referrals down the client’s arm and hand. The therapist treated the client bilaterally with a 2:1 ratio, spending more time on the left elevated side; the client’s posterior suboccipital muscles were released. This corrected the positioning of his tilted head and increased his cervical range of motion. A total of 6 hours in 3 days was spent restoring symmetry to his thoracic and cervical muscles.

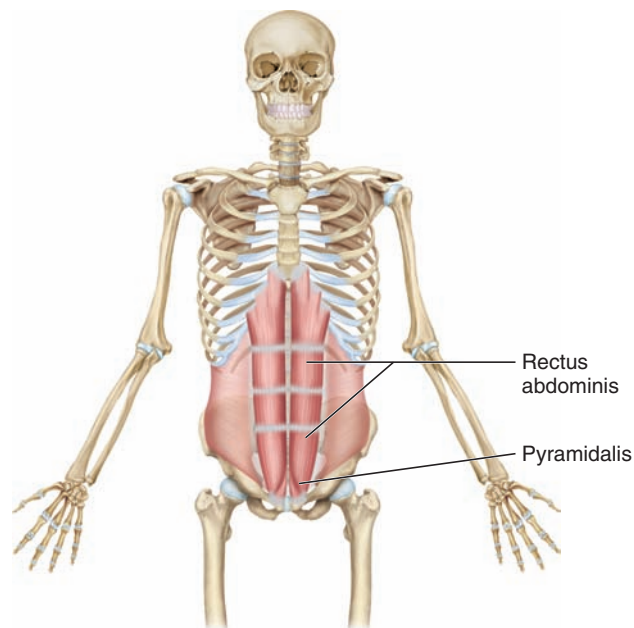
Slow, focused, and isolated work in the appropriate areas produced remarkable results. These results were leveled shoulder girdles, lengthened abdominal muscles with increased fluid trunk rotation, a substantial increase in cervical hyperextension and rotation, and full reduction of symptoms in his hands and better overall posture. The client experienced no discomfort during the therapy sessions and no residual discomfort during his tournament play.

ABDOMINALS**RECTUS ABDOMINIS,** FIGURES 7.1 AND 7.2

ORIGIN	Costal cartilages 5, 6, and 7
INSERTION	Anterior pubic bone
ACTION	Flexes vertebral column; compresses abdominal contents
MYOTOME	T7–T12

EXTERNAL OBLIQUE, FIGURES 7.3 AND 7.4

ORIGIN	Lower eight ribs
INSERTION	Abdominal fascia, iliac crest, and linea alba
ACTION	<i>Bilaterally:</i> flexes trunk; compresses abdominal contents <i>Unilaterally:</i> laterally flexes trunk; rotates trunk to opposite side
MYOTOME	T8–T12

FIGURE 7.1 **Rectus Abdominis Muscles**

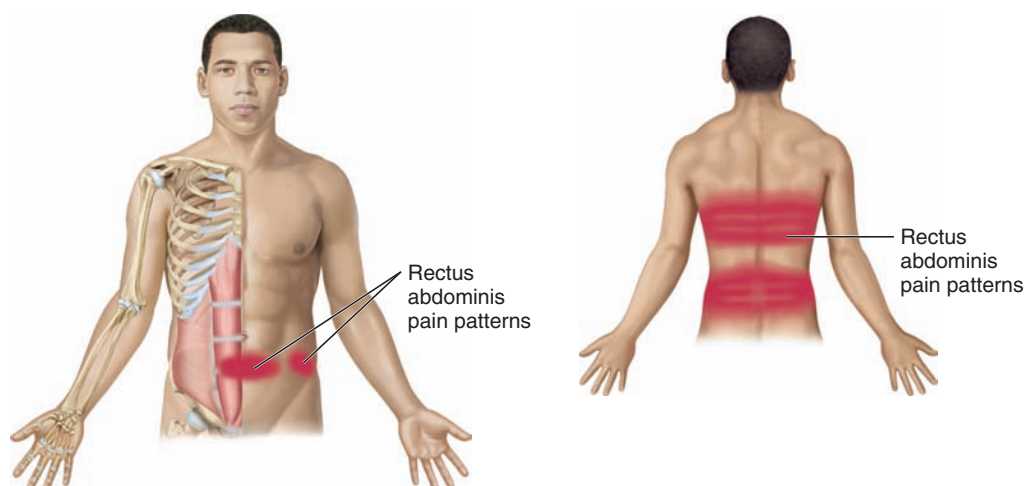


FIGURE 7.2 **Rectus Abdominis Muscle and Referred Pain Patterns**

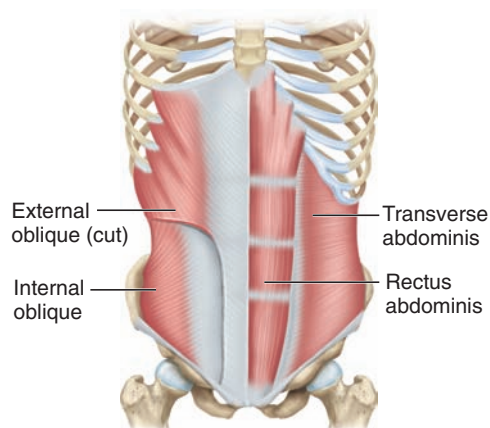


FIGURE 7.3 **External and Internal Obliques and Transverse Abdominis Muscles**

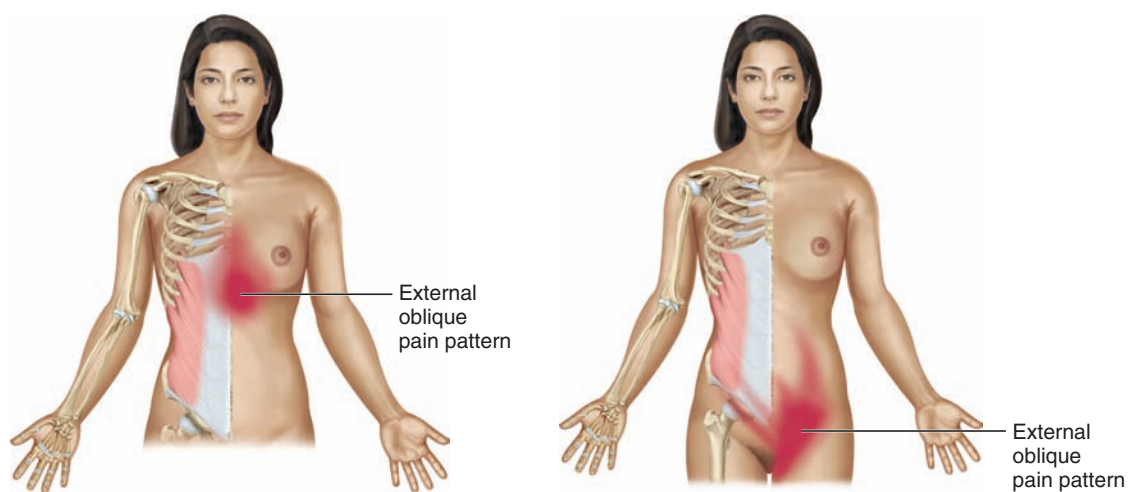


FIGURE 7.4 **External Oblique Muscle and Referred Pain Patterns**

INTERNAL OBLIQUE, FIGURES 7.3 AND 7.5

ORIGIN Inguinal ligament and iliac crest

INSERTION Costal cartilages of last four ribs, abdominal fascia, and linea alba

ACTION *Bilaterally:* flexes trunk; compresses abdominal contents

Unilaterally: laterally flexes trunk; rotates trunk to same side

MYOTOME T8–T12

TRANSVERSE ABDOMINIS, FIGURES 7.3 AND 7.6

ORIGIN Inguinal ligament, iliac crest, and thoracolumbar fascia

INSERTION Abdominal fascia, linea alba, and pubis

ACTION Compresses abdominal contents

MYOTOME T7–T12

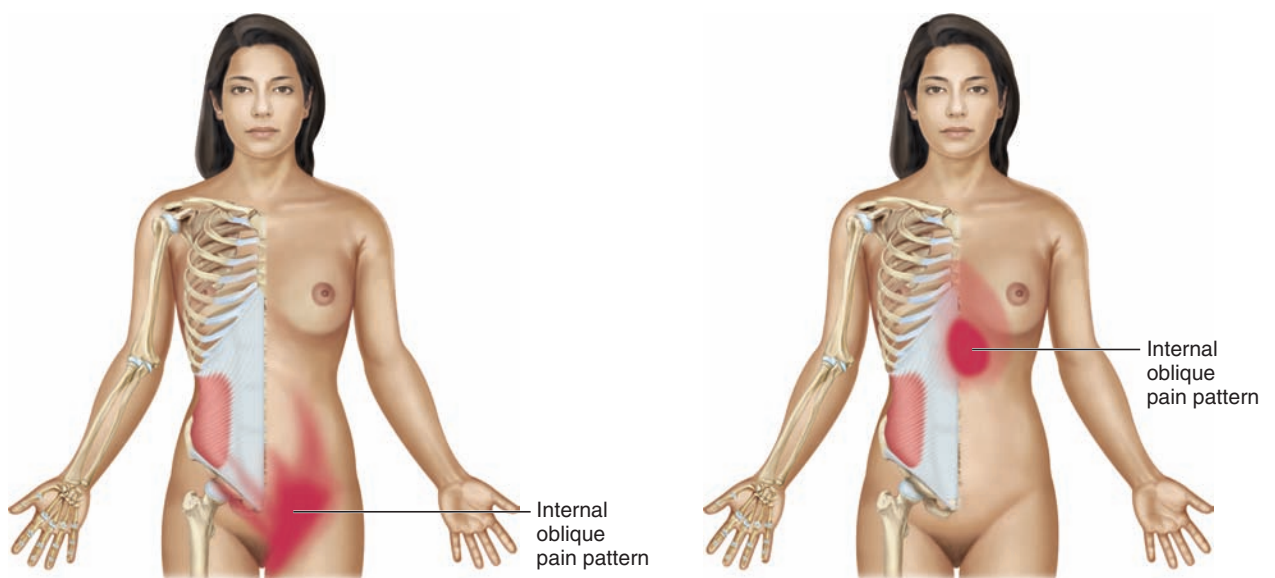


FIGURE 7.5 Internal Oblique Muscle and Referred Pain Patterns

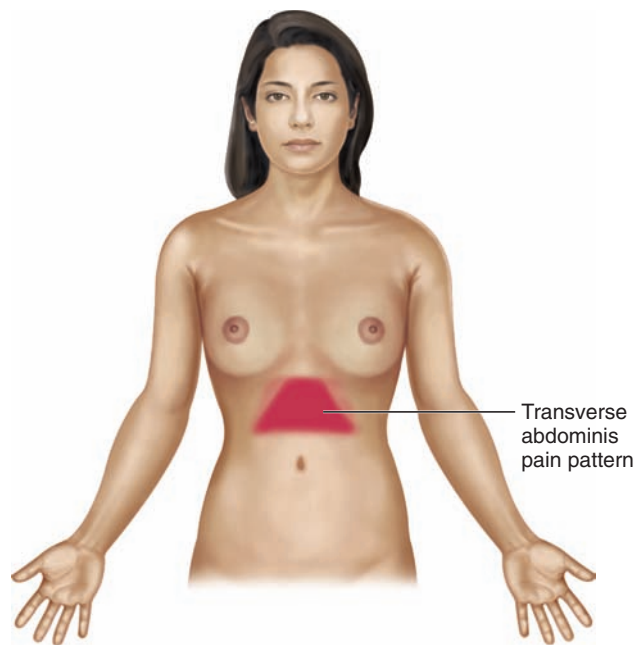


FIGURE 7.6 **Transverse Abdominis Referred Pain Pattern**

CLINICAL NOTES: Abdominals

The abdominal muscles lie in the following order from superficial to deep: rectus abdominis, which runs superior to inferior; external oblique, which travels toward the midline; internal oblique, which travels away from the midline; and transverse abdominis, which travels horizontally around the abdominal contents.

The abdominals work together to compress the abdominal contents and hold them in place. The transverse abdominis, being the primary, deepest abdominal muscle, creates a proper and true, non-compressive extension of the lumbar spine, or proper lordosis. The transverse abdominis also lifts the rib cage upward, taking the pressure off the lumbar vertebrae (decompressing the lumbar vertebrae by about 30 percent), and is the prime assister of complete exhalation. The rectus abdominis attaches midline to the rib cage and travels vertically to the pubic bone; therefore, it is the prime flexor of the trunk at the waistline. The internal oblique rotates the trunk toward the same side, while the external oblique rotates the trunk toward the opposite side; therefore, the internal and external obliques are synergistic to each other on opposite sides and antagonistic to each other on the same side. Both the internal and external obliques also contribute to lateral flexion of the trunk; rectus abdominis flexes the vertebral column.

Any sustained pain (acute or chronic) of the abdomen should be referred to a primary care physician for proper medical and diagnostic evaluation. Abdominal pain can be the cause or result of a somatic-visceral response or a visceral-somatic response. In other words, it is very difficult to determine if the underlying problem is within the internal organs or the muscles, bones, and so on.

The primary referred pain pattern of the oblique muscles is in the upper abdominal quadrants just below the sternum; this pain is often confused with symptoms of gastrointestinal disturbances. Lower abdominal pain can also be associated with trigger point pain referring from the oblique muscles, which can facilitate pain into the groin and genitalia, thereby producing symptoms of urinary and bladder disturbances.

Increased tension in the abdominal musculature can be the result of physical activities that require a vigorous full-body twisting motion, sit-ups and other similar abdominal exercises, chronic occupational strain, structural anomalies, and/or functional deviations of the pelvis or lower extremities. Shallow breathing is also a sign of tight abdominals.

A “seated-chair client” is a person who spends most of the time sitting. Inadequate lumbar support over a long period of time, as seen in occupations that require sitting, will often cause a seated-chair client to slouch. Sitting slouched causes posterior rotation of the pelvis and loss of lumbar lordosis. This poor postural habit weakens the transverse abdominis, further facilitating the flattening of the lumbar spine. Even though the space is decreasing between the rib cage and the pelvis from slouched posture, the transverse abdominis is often left slack and often loses its ability to function properly. As the space between the rib cage and the pelvis decreases, so does the space for the abdominal contents. Loss of space increases the abdominal pressure and forces the abdominal contents to “pooch out”; this further inhibits the function, maintaining lumbar lordosis. Slouched and stooped postures also involve the serratus anterior. The serratus anterior muscle is the primary protractor of the scapula, and its fibers interdigitate with those of the external oblique along the anterior-lateral rib cage. Protraction from the serratus anterior will cause the scapula to slide forward around the rib cage, further shortening the pectoral muscle and bringing the arm toward the chest; this is viewed as a rounded shoulder. It must be emphasized again that short trunk flexors and short hip extensors cause stooped posture and that, to avoid future problems, lengthening of the abdominals and hamstrings is essential in restoring the body to an upright physiologically efficient posture. Pain is a signal of abnormal physiology; and the signaling of pain is often a sign of neuromuscular exhaustion from chronic muscle and nerve tension and is frequently experienced in the lengthened posterior torso muscles of the lower back, neck, and shoulders. These frequently experienced pain symptoms are the body’s way of communicating that it’s tired of holding the body upright from the forward collapsing that is associated with stooped posture. The muscles of the posterior torso, primarily the extensors and retractors, countertighten in an effort to support the upper body and resist its falling forward off the gravitational line. Forward neck and head positioning resulting from stooped posture causes posterior neck pain, especially at the base of the occiput. Shortening of the posterior suboccipital muscles compresses the suboccipital joints, as this is the body’s last-ditch effort to rock the head back, leveling the eyes to the horizon. These compressed joints often cause headaches and restrict cervical motion.

Postoperative scar tissue in the abdominal area can be treated with massage therapy. Interweaving fascial bands around an incision site should be treated. However, reducing the muscle tension in the muscle bellies will ultimately produce better results, as releasing and lengthening the musculature will assist in the softening of the scar. Superficial work, including fascial stretching along the Langer

lines, is very beneficial when the therapist is working with scarring. At the level of the waist and the abdomen, the Langer lines wrap around the body horizontally. *Langer lines* are lines of tension in the skin's elastic component due to the alignment of the collagen fibers in the dermis. They are used frequently in surgical procedures as a guide for cutting. If a cut is made along a Langer line, the scar is likely to be less severe; cutting across a Langer line will cause a more prominent scar. These lines often follow the skin's natural wrinkles.

ROUTINE: Abdominals

Position of client: supine.

Any sustained pain (acute or chronic) of the abdomen should be referred to the primary physician for proper medical and diagnostic evaluation.

1. Treat the anterior torso compartment with compression, separating the muscle divisions from the pubic bone to the rib cage. (See Figure 7.7.) Continue superiorly through the sternal and pectoral regions in a fan-shaped pattern ending at the clavicles.
2. This is a bilateral treatment; if the leg lengths are even, choose one side to treat first. If the client's leg lengths are uneven, spend more time treating the shorter-leg side in a 2:1 ratio, as opening the space between the rib cage and the pelvis will often allow the pelvis to drop and the rib cage to raise up, often leveling the iliums and leg lengths. Find the midline border (linea alba), and begin treatment directly lateral to the midline and inferior to the rib cage, using compression and slow gliding to treat the rectus abdominis muscle (Figure 7.8). Move inferiorly and continue static compressions making a total of four contact points before reaching the pubic bone.
3. Flex the trunk laterally, away from the side being treated. Move laterally into the obliques, and continue treatment with compression and slow gliding. Hold static compression at each contact when muscle tension is felt. Isolate approximately four contact points from the upper to lower abdominal wall. Treat each contact point with slow, deep compression while maintaining the client's edge. This allows the client to fully relax, thereby allowing you, the therapist, to proceed further into the deeper layers of the abdominal wall. (See Figure 7.9.) In

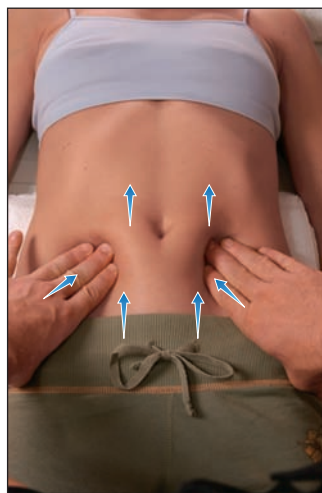


FIGURE 7.7

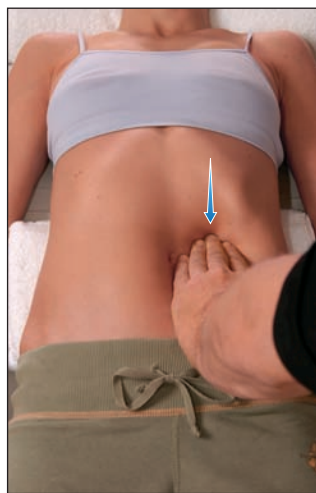


FIGURE 7.8

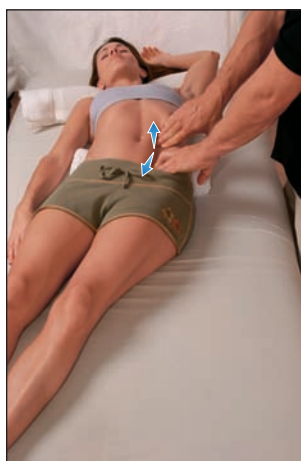


FIGURE 7.9a



FIGURE 7.9b



FIGURE 7.9c



FIGURE 7.9d

Figure 7.9d, the use of the elbow gives a broader contact point and a deeper compression into the muscles and should be practiced. Sitting in a comfortable position and leaning forward will allow you to sustain the broader compression for longer periods as well as rest your fingers.

4. Have your client turn to a side-lying position, arm extended over the head. Place a bolster in the space between the pelvis and the rib cage. Treat the lateral abdominal wall with myofascial stretching along the Langer lines with both hands moving horizontally down toward the table. (See Figure 7.10.)
5. Using the fingertips of one hand while stretching the myofascia with the other, treat the obliques with compression and myofascial stretching at the level of the waistline. Continue around the waistline from anterior to posterior, further treating the abdominals with compression and stretching. (See Figure 7.11.) Treat slowly, following the client's edge.
6. Using the thumbs, treat the muscles attaching to the rib cage with slow compression and friction. Opening up the spaces between the ribs will allow a fuller expansion of the rib cage on deeper inhalation. (See Figure 7.12.) Coach the client in deep breathing, and encourage the client to focus on full relaxation. Maintain the client's edge to avoid any pain or increased discomfort while continuing treatment throughout the anterior and lateral rib cage.



FIGURE 7.10



FIGURE 7.11

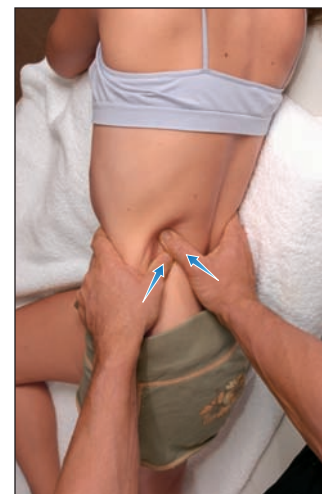


FIGURE 7.12

ILIOPSOAS**PSOAS MAJOR,** FIGURES 7.13 AND 7.14

ORIGIN Vertebral bodies, intervertebral disks, and anterior transverse processes of T12–L5

INSERTION Lesser trochanter of femur

ACTION Flexes hip; flexes lumbar vertebrae; controls rate of extension of lumbar vertebrae; proximates lumbar vertebrae toward femur

MYOTOME L1–L4

ILIACUS, FIGURES 7.13 AND 7.14

ORIGIN Inner surface of iliac fossa

INSERTION Lesser trochanter of femur

ACTION Flexes hip

MYOTOME L2, L3

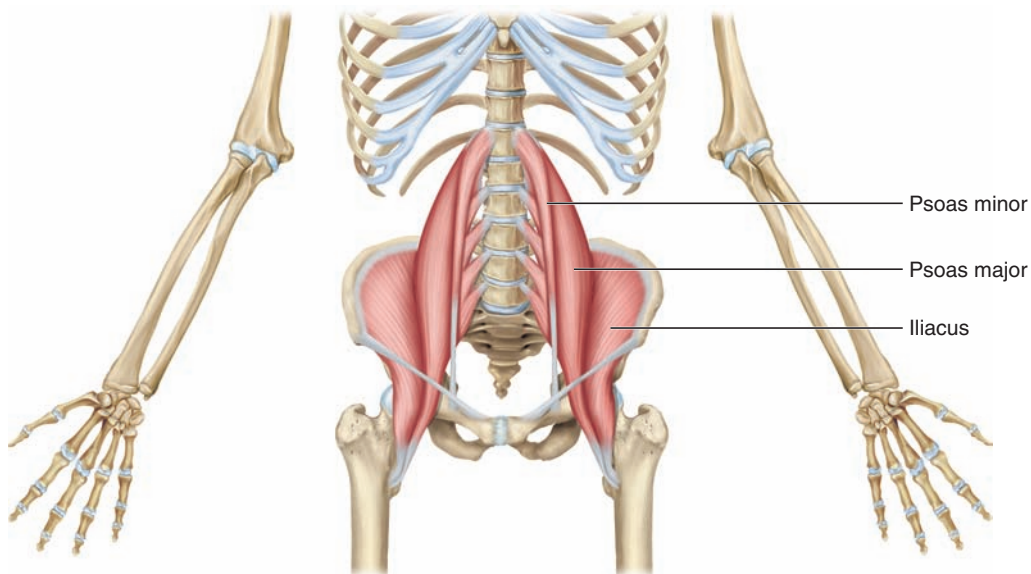


FIGURE 7.13 **Iliopsoas Muscles: Psoas Major, Psoas Minor, and Iliacus**

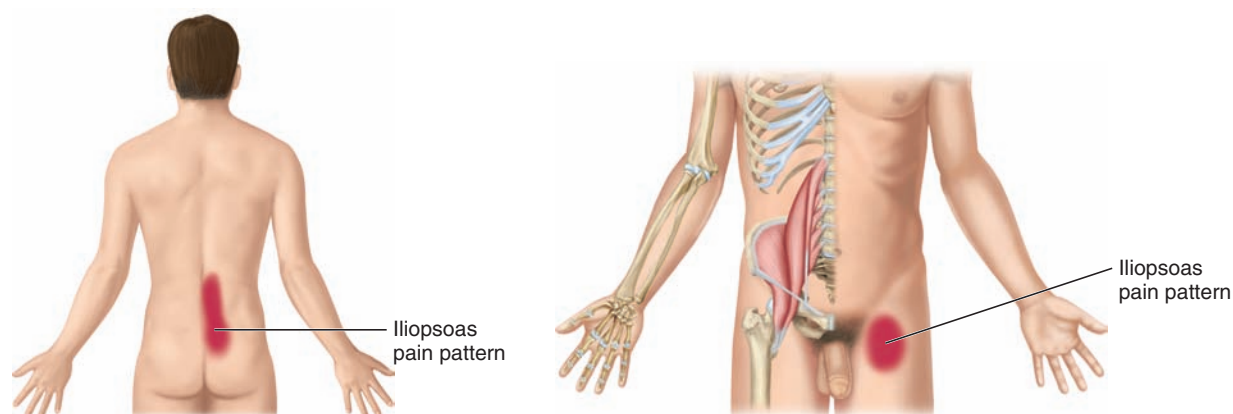


FIGURE 7.14 **Iliopsoas Muscles and Referred Pain Patterns**

CLINICAL NOTES: Iliopsoas

The iliopsoas is composed of two distinct muscles: the psoas major and the iliacus—with one common attachment. The psoas major arises from the lumbar vertebrae. The iliacus originates from the inner surface of the iliac fossa and is well established as the primary hip flexor. They both insert on the lesser trochanter of the femur. Psoas major is the only muscle that attaches the lumbar spine to the femur.

Many people think of the psoas as a primary postural stabilizer of the spine. Although it is often recruited as a postural stabilizer, that is not the proper or best use of the musculature. Other muscles are far more suited to this stabilizing function. If the overall structure remains open or decompressed and the posture is properly balanced in gravity, the psoas remains free to do its primary job, which is to produce, assist, and accommodate movement and action.

Functions of Psoas

There is no debate that the psoas major is a hip flexor. Yet there is much debate among researchers as to whether the iliopsoas is a flexor or an extensor of the lumbar spine.

Part of the confusion is that the psoas major is a hip flexor, and hip flexion is usually associated with, and often to some degree causes, increased lumbar extension or lordosis. As hip flexors rotate the pelvis anteriorly, the pelvis draws the spine forward with it. All things being otherwise equal, the lumbar vertebrae would most likely fan forward into a lordosis. Other muscular factors, however, resist this action.

(For clarification, it should be noted that the lifting of the femur toward the pelvis and the tilting of the pelvis down toward the femur are both, technically speaking, the same action: flexion of the hip. More precisely, hip flexion is a closing or decreasing of the angle between the femur and pelvis toward the front of the joint. Conversely, a posterior tilt of the pelvis is hip extension. Learning to think about joint movement in this fashion increases the student's ability to analyze posture and structure more precisely and efficiently.)

A number of factors influence the various actions of the psoas muscles. When the psoas contracts, it draws the femur up toward the spine, assuming that the spine is more stabilized than the femur.

If, however, the femur is more stabilized than the spine, the psoas draws the spine toward the femur, causing the spine to flex forward.

An increase in lumbar lordosis is by definition an increase in the curve of the lumbar spine. In a true lumbar lordosis, the vertebral bodies must be able to fan open toward the front of the abdomen, which is why true lumbar lordosis is synergistic with the chest, head, and neck moving up and back, not forward and down.

When viewed from the side, the psoas major lies in an almost vertical line along the lumbar spine and must pull each vertebral body downward toward the pelvis and femur. When this occurs, the psoas is actually decreasing the space between the vertebral bodies; flattening the lumbar arc. If there is a decreasing arc or arch in the lumbar spine, the vertebral bodies move closer to each other and the spinal disks are compressed. The overall spine moves forward and downward toward the femur; the lumbar vertebrae do not fan open to create lumbar extension—they close, creating lumbar flexion.

The psoas major muscle is, therefore, with a minor but significant exception at the L5-S1 joint (discussed later in this chapter), primarily a lumbar flexor. The psoas major does not create true lumbar extension or contribute to an actual lumbar lordosis; it actually resists it.

Psoas Controls Lumbar Extension

If the torso starts to lean backward, the psoas major will generate an eccentric contraction (a controlled lengthening by gradually reducing the level of tension) to prevent the spine from lengthening too far and too fast.

Psoas Reacts to Other Muscles

If the body is slouching forward and the abdominal wall and hip extensors are chronically short, it is far more common for the lumbar spine to be forced posteriorly and into chronic flexion. This draws the lumbar vertebral bodies toward each other, increasing compression of the spinal disks.

In response to the lumbar spine being pushed posteriorly (rearward) and the pelvis moving into a posterior tuck, the psoas major, being a hip flexor, contracts in an attempt to counteract the posterior pelvic tilt and flattening of the lumbar spine. But at this point, psoas is incapable of actually accomplishing this counteraction. Yet in its attempt to do so, the psoas major contracts across the vertical line through the lumbar vertebrae.

If indeed it is determined that psoas is contracted by way of reacting to overshortening of the hip extensors and abdominal wall, then, in therapy, one must release the abdominal flexors—the rectus abdominis, and external and internal obliques—and hip extensors—hamstrings, adductor magnus (long portion), gluteals, deep rotatores—to a significant degree before attempting to release the psoas major muscles. In many cases treating the psoas major without first addressing these muscles either ensures that the problem will quickly return or makes the problem worse in the long run.

Compression of Lumbar Spinal Disks

To reiterate, the psoas major muscle is perfectly placed to apply direct powerful downward forces that actually compress the lumbar vertebral bodies. This is a flexion, not an extension, of the lumbar spine. As the vertebral bodies compress and move toward each other, the disks in between the

vertebral bodies must be compressed as well. This is, potentially, a common cause of long-term chronic disk degeneration from slight narrowing to total herniation and rupture. This condition often produces no pain, which is why it is often doubtful that compression of disks is necessarily the cause of back pain. Other than cases in which the disk protrudes back into the spinal canal and/or the neural foramina, the disks seldom have an opportunity to be the direct cause of pain.

Much back pain is caused by muscles irritating and sometimes entrapping sensory nerves. Many nerves run through and behind the psoas muscles and are subject to irritation and compression. Muscle tension also produces vertebral dysfunction and disk pathology often from muscles distant from the posterior torso, such as the hamstrings, gluteals, and abdominal muscles.

The Pars Vertebralis of Psoas

The pars vertebralis portion of the psoas consists of small slips of muscle, which are the deepest layers of the psoas major, linking from the 12th thoracic vertebra to the lumbar vertebral bodies (T12 through L5). This usually unnoticed portion of the psoas major is a direct flexor of the lumbar vertebral column and compressor of the intervertebral disks. (See Figure 7.15a.)

The pars vertebralis portion of the psoas major and the deepest fibers of the main body of the psoas major are the most inaccessible layers. Applying low-dose, micro-movement stretching (various small and gentle arching movements of the lumbar spine) is a way to access these muscles, although stretching does not in all cases immediately create the necessary changes if the involved fibers are too traumatized. A shortened or traumatized psoas requires the approach of the minimum-edge technique, which often requires manual therapy to assist the psoas stretch.

While it is true that the psoas major is, along with the iliacus, a primary hip flexor, it simultaneously is a lumbar flexor and actually limits or reduces lumbar extension, preventing true excess lordosis and sometimes eliminating it altogether. This is because the overall bulk, the most superficial portion of the psoas muscle, runs parallel with, and is also capable of compressing, the lumbar vertebrae.

“Mini-” or “Pseudo-” Lordosis

The minor but significant exception referred to earlier is produced by the structure of the L5-S1 joint. Because the 5th lumbar, as viewed from the side, appears as if it were positioned on a small, downward-sloping shelf projecting forward from the top of the sacrum, the psoas major can also be a powerful force pulling the 5th lumbar vertebra, and the whole lumbar column, forward and down. It is common to have muscles pulling so hard in opposite directions that while the hip extensors attempt to rotate the pelvis posteriorly, the psoas attempts to rotate the lumbar spine anteriorly. This causes a forward and downward shearing action of the L5 vertebrae that creates a “kink” at the posterior face of the lumbosacral joint. The “kink” contributes to the illusion of the “deep curve” in the lumbar area. A quick look by an untrained eye can mistake this “mini-” or “pseudo-” lordosis at the base of the posterior spine (which is restricted to the L5-S1, and possibly L5-L4, area) and other common postural illusions for a true lordosis of the entire lumbar spine. (See Figure 7.15b.)

Posterior Fibers of Psoas

Also complicating lower-back pain, though not all of them are directly attached to the lumbar vertebral bodies, are the deepest, most posterior long fibers of the psoas major. These fibers run

upward from their insertion at the lesser trochanter to their origin, attaching to the anterior transverse processes of the lumbar vertebrae and iliolumbar ligaments. If these fibers are excessively and chronically contracted, their pulling force on these ligaments (ligaments being significantly more pain-sensitive than muscle fibers) could be a significant source of pain.

Lumbar Pain Pattern

The iliopsoas, abdominals, hamstrings and the erector spinae, multifidus, rotatores and quadratus lumborum muscles are often the culprits of a failed low back and/or chronic pain because they can generate opposing forces on the pelvis, sacrum and lumbar vertebrae, and intervertebral disks. Prolonged sitting with the hips acutely flexed will cause the iliopsoas to adaptively shorten. This, plus reactive forces from opposing muscles, creates compression, stress, and vertical pain along the spine (lamina groove) and sacroiliac joints. Secondary pain of the iliopsoas muscle will likely be present at the insertion sites on the lesser trochanter of the femur and on the anterior thigh and groin. A hypertense psoas major also contributes to the so-called hip-click phenomena as well.

Asymmetrical imbalances of the iliopsoas may contribute to a compensatory lumbar scoliosis. Both skeletal and myofascial asymmetries can be structural or functional and can occur in the lower

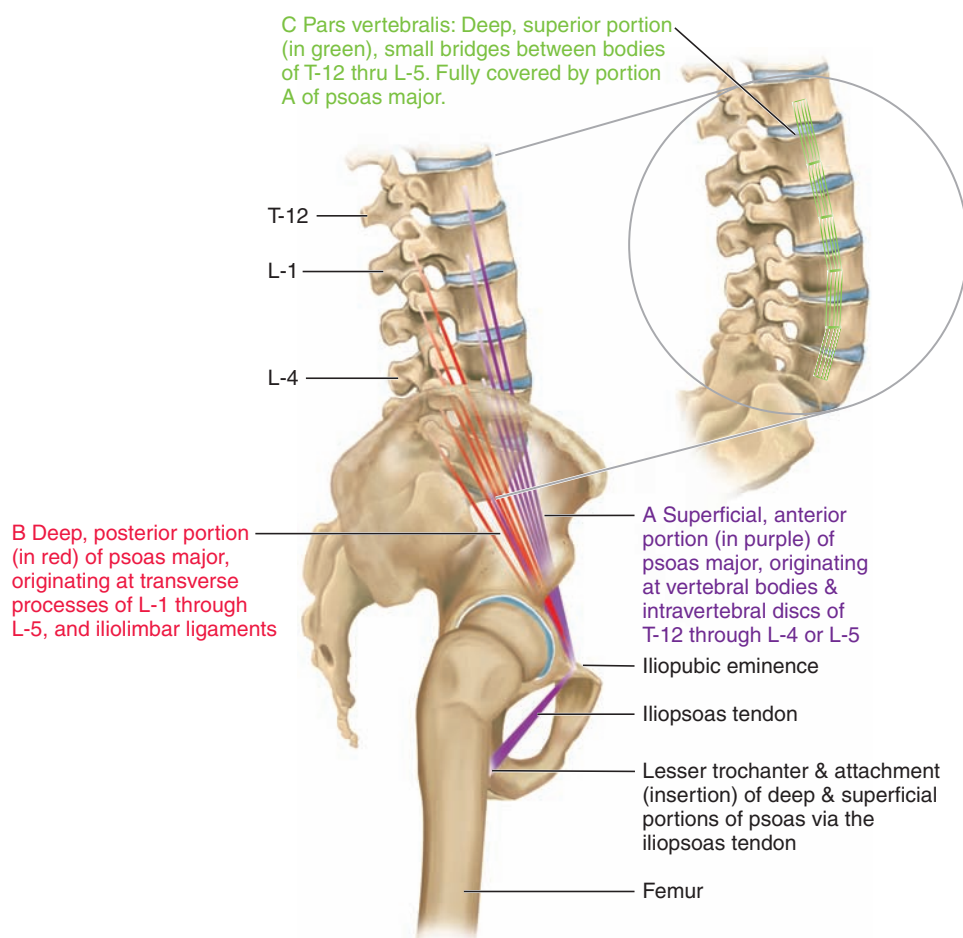
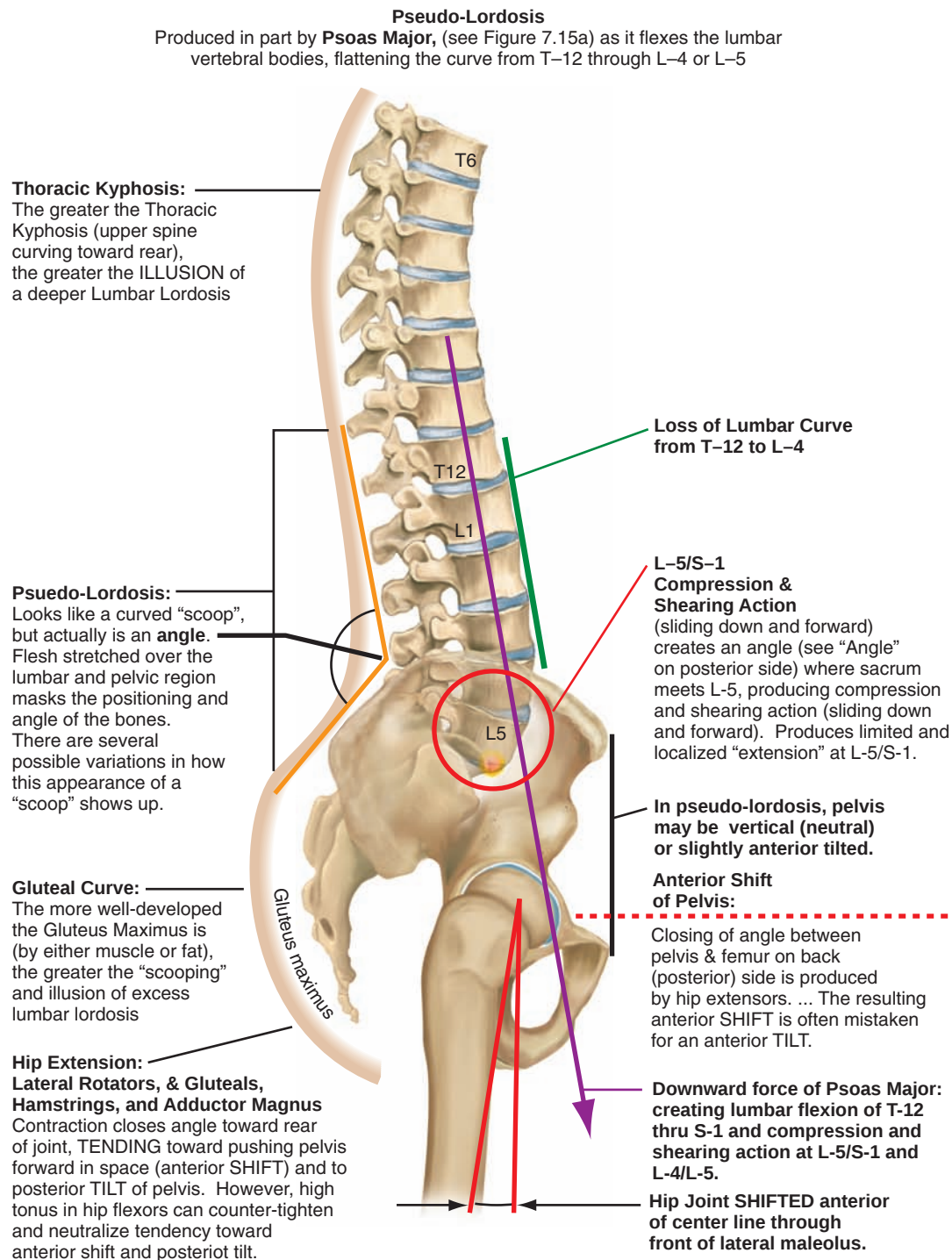


FIGURE 7.15a **Pars vertebralis**



A pseudo-lordosis appears as a deep curve (exaggerated lordosis) of the lumbar spine. Yet often, this is a false illusion as to what is actually occurring in the positioning of the bones. Even with an *appearance* of an exaggerated lordosis or so-called sway back from thoracic region to buttocks, many people in reality have a loss of curve, a straightening, of the actual lumbar vertebrae from T-12 to L-4. The overlying flesh often masks the true picture of what is actually occurring structurally (relationship between the bones). Treating such cases by tucking the pelvis or sacrum, flattening the low back, prematurely releasing the tension on the posterior lumbar spine, and other such actions further compresses the lumbar vertebral discs.

FIGURE 7.15b **Pseudo-Lordosis**

lumbar spine, pelvis, and/or lower extremities. For example, unless countered by an opposing muscle, a hypertonic iliopsoas muscle may cause a client to lean toward the hypertonic side, further involving the obliques, quadratus lumborum, erector spinea and latissimus dorsi muscles on the same side.

ROUTINE: Iliopsoas

Treating the abdominal muscles before treating the iliopsoas is recommended, as the tension in a hypertonic abdominal muscle can prevent lengthening of the iliopsoas.

Position of client: supine.

1. If pain is present in the lumbar and sacroiliac region, bend the knee and laterally rotate and abduct the thigh. Initially, your knee could be used as a temporary bolster while accessing the iliacus and psoas. It is important that the client is comfortable and the abdominal wall is relaxed. Apply compression and slow, deep effleurage to the abdominal wall separating the muscular divisions. (See Figure 7.16.)
2. Place the fingertips just lateral to the rectus abdominis. Use circular pressure to penetrate slowly, gradually proceeding deeper toward the spinal column. Synchronize the circular movements with the client's breathing to help avert her natural tendency to guard against abdominal penetration. (See Figure 7.17.) When the client communicates comfort, proceed into deeper layers, maintaining the client's edge. *No pain means more gain.*
3. To isolate the psoas major, keep the hands in the same place and have the client contract the psoas muscle by flexing the hip toward the chest. Resist the movement at the same time. Once the psoas has been isolated, have the client relax. Using contoured fingertips, explore as much of the psoas as possible from the inguinal ligament, moving superior toward the rib cage. (See Figures 7.18 and 7.19.) Using the edge technique, treat with compression and subtle friction. Suggest that the client use hand signals to ensure effective communication.
4. Using the fingertips of both hands, treat the iliacus muscle where it merges with the psoas major muscle, along the inner surface of the ilium. Penetrate toward the therapy table, staying along the inner surface of the ilium. Periodically have the client contract the iliopsoas group to verify the location. (See Figure 7.20.) *Bend the knee and laterally rotate and abduct the thigh.*
5. Outline the length of the psoas with both hands. Using fingertips and/or contoured hands, apply compression with one hand while the other glides away, applying a deep myofascial stretch. With the fingertips, continue



FIGURE 7.16



FIGURE 7.17



FIGURE 7.18

deep-gliding effleurage up to and as far under the inguinal ligament as the client will allow. (See Figure 7.21.) As the iliopsoas releases, lengthen it further by hanging the client's leg off the therapy table. Be sure to stabilize the leg. Repeat the routine if necessary.

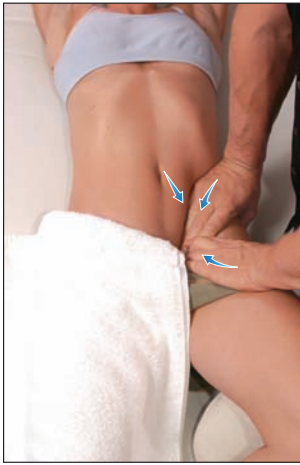


FIGURE 7.19

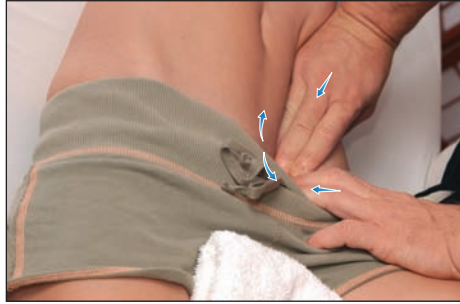


FIGURE 7.20

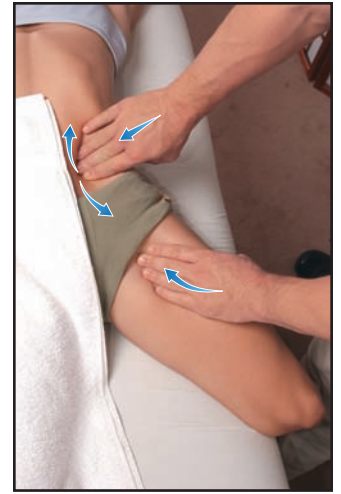


FIGURE 7.21

PECTORALIS MAJOR, FIGURES 7.22 AND 7.23

ORIGIN *Clavicular head:* medial half of clavicle
Sternal head: sternum from manubrium to xiphoid process
Costal head: first six costal cartilage surfaces

INSERTION Lateral lip of bicipital groove of humerus

ACTION Adduction, flexion, medial rotation of humerus; depression of arm and shoulder

MYOTOME C5–T1

PECTORALIS MINOR, FIGURES 7.24 AND 7.25

ORIGIN Anterior 3rd, 4th, and 5th ribs near costal cartilage

INSERTION Coracoid process of scapula

ACTION Protracts, depresses, downwardly rotates scapula

MYOTOME C8–T1

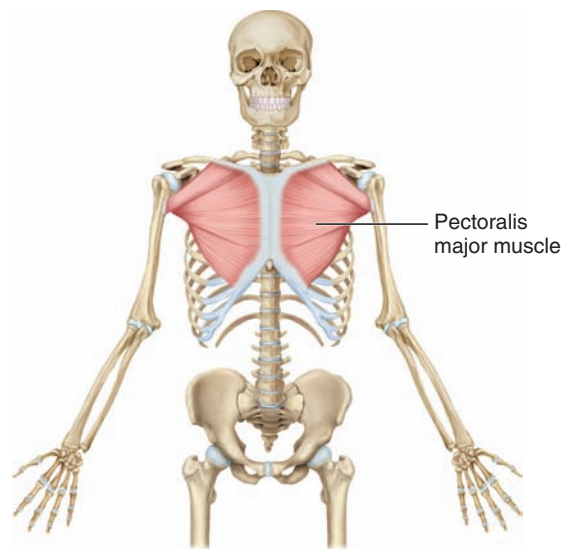


FIGURE 7.22 **Pectoralis Major Muscles**

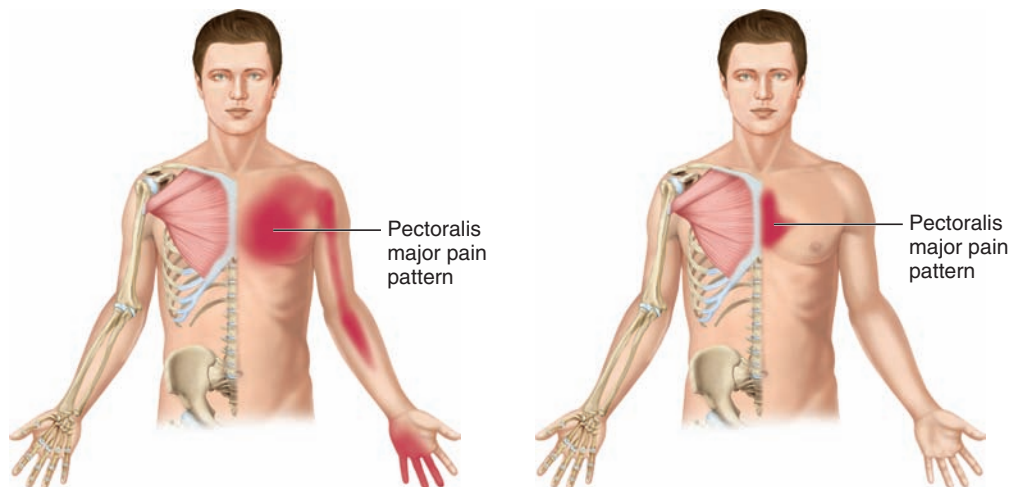


FIGURE 7.23 **Pectoralis Major Muscle and Referred Pain Patterns**

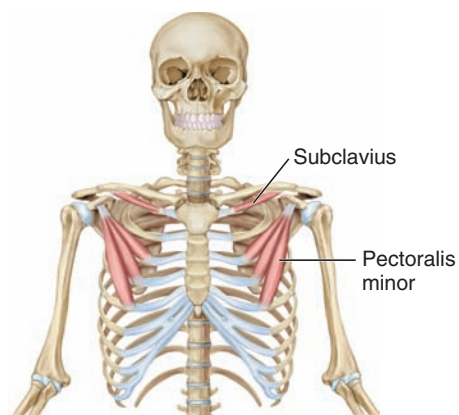


FIGURE 7.24 **Pectoralis Minor and Subclavius Muscles**

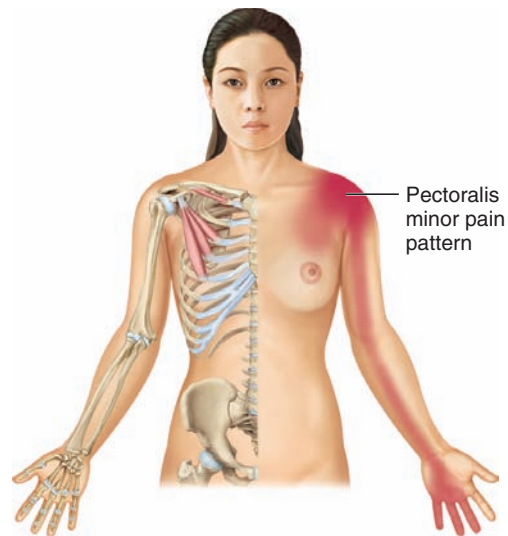


FIGURE 7.25 **Pectoralis Minor Muscle and Referred Pain Pattern**

SUBCLAVIUS, FIGURES 7.24 AND 7.26

ORIGIN 1st rib costocartilage junction

INSERTION Middle third of inferior surface of clavicle

ACTION Depression of shoulder; stabilization of clavicle during shoulder movement

MYOTOME C5, C6

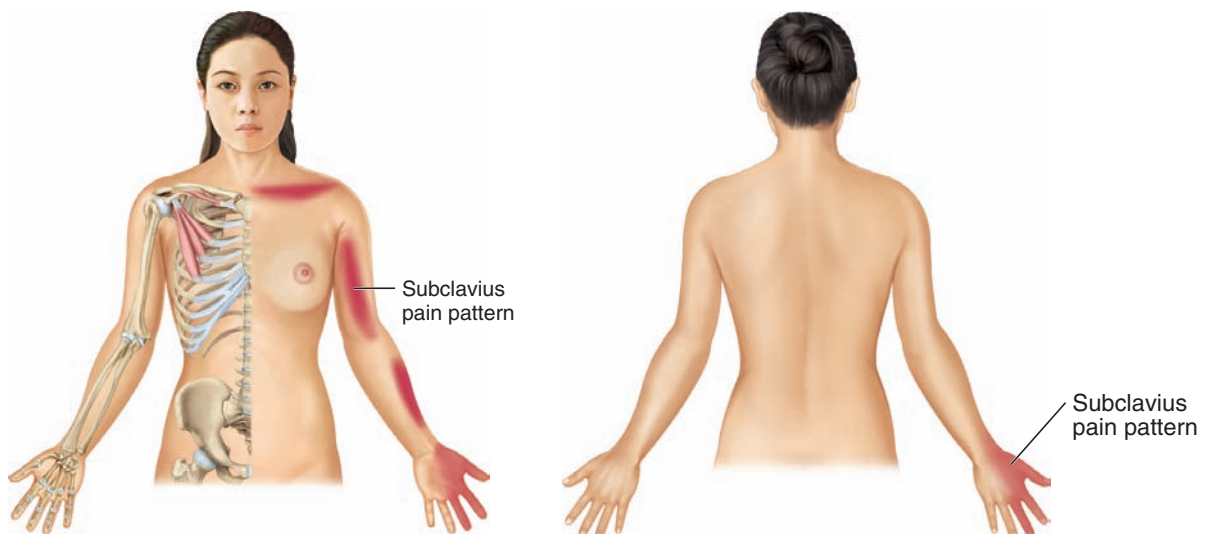


FIGURE 7.26 **Subclavius Muscle and Referred Pain Patterns**

CLINICAL NOTES: Pectoralis Major, Pectoralis Minor, and Subclavius

The pectoralis minor originates on the 3rd, 4th, and 5th ribs and attaches to the coracoid process of the scapula. The subclavius lies on the inferior surface of the clavicle, traveling most of its length and attaching to the 1st rib. The pectoralis major is superficial to both the pectoralis minor and the subclavius. There are three divisions of this muscle—clavicular, sternal, and costal—which originate at different locations, run in different directions, and insert at the same point: the bicipital groove of the humerus.

Because of the varied directions that its three divisions travel and their attachment on the humerus, the pectoralis major influences many movements of the humerus, including flexion, adduction, and medial rotation of the arm, as well as depression of the arm and shoulder. The pectoralis minor assists the serratus anterior in forced inspiration and contributes to protraction, depression, and downward rotation of the scapula. The subclavius stabilizes the clavicle and assists in depression of the shoulder.

Anterior shoulder pain, breast pain, and diffuse soreness are symptoms of trigger point pain referred by the pectoralis muscles. Pain in the shoulder that traces down the arm and into the hand could be a sign of thoracic outlet syndrome: a condition in which the cervical spine compresses toward the rib cage because of anterior cervical muscles' and the pectoralis minor's pulling the shoulder down from the front, thus narrowing the space between the cervical spine and the 1st rib. Also contributing to thoracic outlet syndrome is the latissimus dorsi's pulling the shoulder down from the back and, therefore, pulling the clavicle down and back against the 1st rib. These muscular imbalances can compress and entrap the neurovascular structures exiting and entering the neck, chest, and arm; if left untreated, they can lead to pain, motor weakness, immobility, and atrophy of the shoulder and upper extremity.

Dr. Janet Travell, coauthor of *Myofascial Pain and Dysfunction, Volume I*, refers to the pectoralis major as the “heart attack muscle.” According to Travell, “cardiac arrhythmia” trigger points may be located on the right side, 1 inch lateral to the xiphoid process and 2 inches superior, between the 5th and 6th ribs. The referral pain from these trigger points can replicate the intensity, quality, and distribution of true cardiac pain.

Travell has a second nickname for the pectoralis major: the “poor posture muscle.” A stooped posture is aggravated by the increased tension caused by myofascial trigger points in the pectoralis major muscle. Increased tension in the anterior torso muscles that results in stooped posture causes the rib cage to be pulled down and forward; this causes the pectoral muscles to adaptively shorten. This pulls the shoulders inward, rounding the shoulders. As this kinetic chain, initiated by the abdominals, shortens, the neck and head move forward and down, further shortening the anterior neck muscles. The farther the neck and head move forward off the gravitational line, the more the suboccipital muscles compress. This tightening at the base of the occiput is the body's last-ditch effort to hold the head upright, leveling the eyes to the horizon. Poor sitting postures arise from inadequate lumbar support. A lumbar support (e.g., a rolled-up towel placed in the small of the

back) will cause the pelvis to rotate anteriorly, facilitating a lumbar curve and taking pressure off the lumbar disks. This natural curve (lordosis) will pull the upper body back on plane, increasing the natural curve of the neck and opening up the chest, thereby facilitating a more efficient posture.

The three divisions of the pectoralis major should be treated independently with treatment directed into the muscle bellies and toward their attachment on the humerus. Treatment to the pectoralis major should also include the subscapularis, latissimus dorsi, teres major, serratus anterior, and abdominal musculature in order to separate and identify any areas of restriction. *Note:* The chest wall is a highly sensitive area for most people; the cervical and axillary lymph nodes drain in the chest, where there can be metabolic waste accumulation, causing hypersensitivity.

ROUTINE: Pectoralis Major, Pectoralis Minor, and Subclavius

Position of client: supine, with the client's arm extended away from the body. Support the arm with an extended bolster if the arm does not fit on the table, but allow the client's hand to hang off the table. (See Figure 7.27.)

1. Treat the anterior torso compartment with slow, deep effleurage from the pubic bone, over the rib cage, and superiorly in a fan-shaped pattern through the sternal and pectoral region, ending at the clavicles.
2. Using the fingertips, apply compression and friction along the muscle fibers, separating the three muscular divisions of the pectoralis major.
3. Using the fingertips, slowly compress downward and apply slow, rhythmical friction to the pectoralis minor by treating the pectoralis major. (See Figure 7.28.)
4. Isolate the pectoralis major by picking it up, off the rib cage. Treat with compression. Using thumbs and fingers, friction in 1-inch segments. (See Figure 7.29.)
5. Using a collapsed fist, treat the pectoralis major from the sternum to the humerus with deep, slow effleurage.
6. Contour one hand along the lateral rib cage, and slowly apply inward compression into the pectoralis minor while the other hand lightly lifts the pectoralis major. (See Figure 7.30.)



FIGURE 7.27



FIGURE 7.28

7. Maintain the same contoured hand position. Glide superiorly toward the coracoid process while lifting the arm toward the ceiling and pulling it posteriorly to stretch the myofascia. Compress the fingers down on the pectoralis minor. Hold static compression in 1-inch segments. Use the edge technique for maintaining the client's comfort. (See Figure 7.31.)

Have the client move to the side-lying position to ensure that the pectoralis major is off the rib cage, exposing it and the pectoralis minor for treatment. Sit at the side of the table at the client's waist. Place the client's arm out in front of his or her body.

8. Place one hand around the client's scapula. Place the other hand underneath the client's arm, and grasp the pectoralis major. Treat with slow, firm petrissage, exploring the muscular divisions. (See Figure 7.32.) Face the palm toward the rib cage, and point the fingers inward. Separate the pectoralis major from the underlying pectoralis minor muscle, and slowly compress the pectoralis major in 1-inch segments. Move, and reenter the compression. Using a contoured hand, treat the pectoralis minor along the rib cage with compression and circular friction. Use the edge technique for maintaining the client's comfort. (See Figure 7.33.)
9. Allow the client's arm to roll forward so that the clavicle lifts off the upper ribs. Using the fingertips of one hand and the thumb of the other, treat the subclavius muscle underlying the clavicle with static compression. Apply friction in 1-inch segments. (See Figure 7.34.)
10. Using the fingertips, glide along the inferior border of the clavicle and re-treat the pectoralis major around the attachment and the subclavius muscle, as shown in Figure 7.34.



FIGURE 7.29



FIGURE 7.30



FIGURE 7.31



FIGURE 7.32



FIGURE 7.33

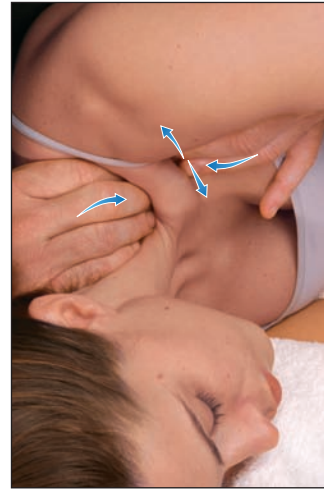


FIGURE 7.34

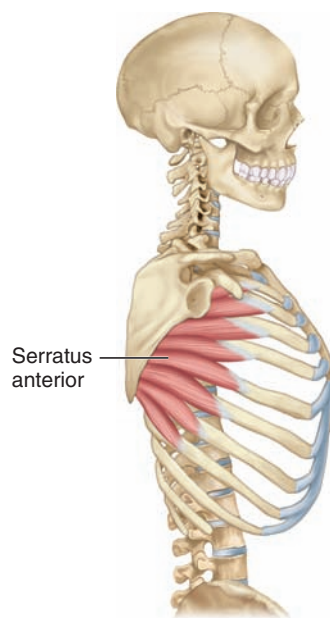
SERRATUS ANTERIOR, FIGURES 7.35 AND 7.36

ORIGIN Upper nine ribs

INSERTION Anterior vertebral border of scapula

ACTION Protracts scapula; rotates scapula upward

MYOTOME C5–C7

FIGURE 7.35 **Serratus Anterior Muscle**

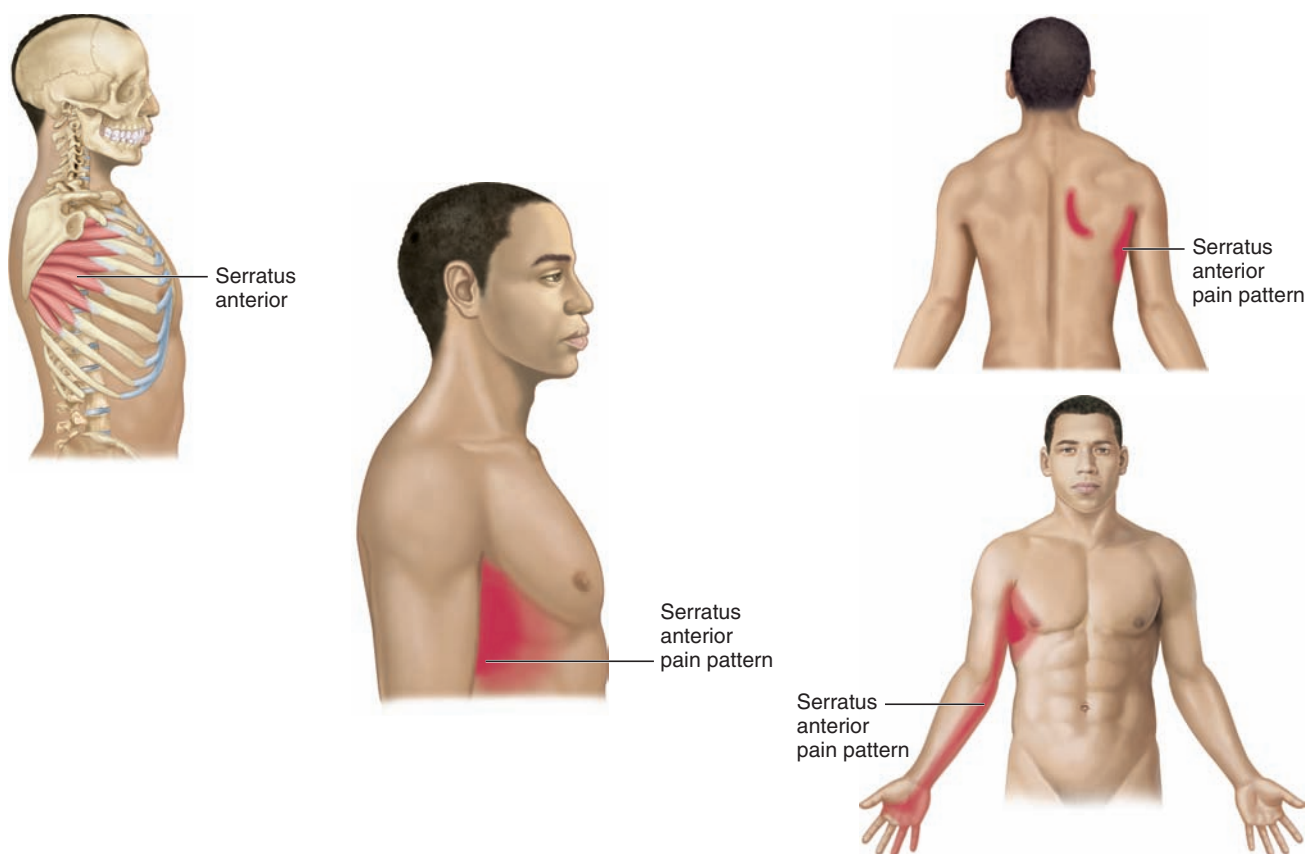


FIGURE 7.36 **Serratus Anterior Muscle and Referred Pain Patterns**

CLINICAL NOTES: Serratus Anterior

The serratus anterior anchors the scapula to the thorax, originating on the upper nine ribs and attaching on the entire anterior vertebral border of the scapula from the inferior angle to the superior angle. The lower fibers of the serratus anterior interdigitate with the upper fibers of the external oblique where they attach to the lower ribs. These fibers can pull the inferior angle of the scapula forward, causing the scapula to rotate upward elevating the shoulder girdle. From a posterior view, the vertebral border of the scapula will appear to protrude from the body.

The primary function of the serratus anterior is protraction of the scapula, assisted by the pectoralis minor and upper fibers of the pectoralis major. The serratus anterior also assists the upper fibers of the trapezius, rhomboids, and levator scapulae in elevating the scapula; therefore, an abnormally protracted or an elevated scapula may be a clinical indication for treating the serratus anterior muscle.

Shortening of the pectoralis major, pectoralis minor and the serratus anterior is often the result of stooped posture and can cause rounding of the shoulders, pain in the anterior and lateral chest wall, and a restricted expansion of the chest wall on inspiration. If the pain is perpetuated by a forced protraction of the shoulder, it is likely that the serratus anterior is involved.

ROUTINE: Serratus Anterior

Position of client: side-lying.

1. Using the fingertips, treat the lateral torso with slow, deep effleurage; stretching the myofascia from the iliac crest to the axilla, continuing to the olecranon processes of the ulna. (See Figure 7.37.)
2. With a contoured hand and the fingertips, glide along the rib cage, simultaneously compressing the serratus anterior onto the rib cage. (See Figure 7.38.) Position the other hand under the vertebral border of the scapula. Glide both hands toward each other, simultaneously lifting the scapula toward the ceiling. Perform movement palpation (protraction and retraction) of the scapula.
3. Using flexed fingertips, treat the underlying surface of the vertebral border of the scapula with friction in 1-inch segments. (See Figure 7.39.)
4. Using fingertips, treat along the upper nine ribs with compression and slow, deep effleurage. Then apply a broad, slow and isolated friction in 1-inch segments. (See Figure 7.40.)
5. Using the fingertips, treat the muscles along the lamina groove with friction while retracting the shoulder girdle for easier access. (See Figure 7.41.)



FIGURE 7.37

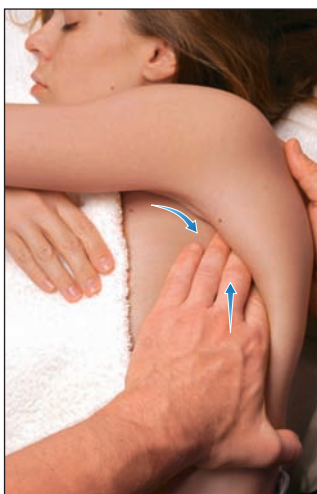


FIGURE 7.38



FIGURE 7.39

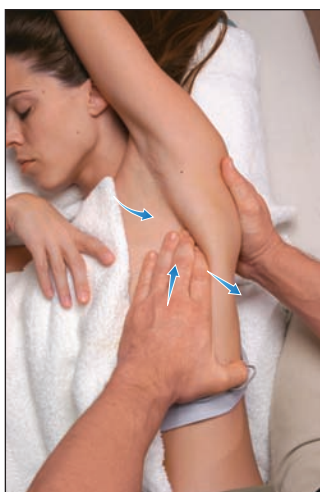


FIGURE 7.40



FIGURE 7.41

CERVICAL MUSCLES

Prior to treating the cervical muscles, treat the compartment distortions from the originating sources, which lead up to and affect the muscles of the neck.

Important: By now, a complete postural assessment and palpatory examination of the client's posture and compartment imbalances should have been done and understood. This helps to clarify the client's pain patterns and perpetuating factors, which provide the therapist with a specific plan of treatment, especially if the client's pain has been chronic. Chronic neck pain in the back of the neck is often experienced when a loss of cervical curve or straightening of the cervical spine is present. In severe cases the cervical spine actually reverses. The farther the spine straightens or reverses, the more downward force is applied to the disks in front. This causes the disks to migrate posterior and lateral, often protruding into the nerve roots where the nerves exit the neural foramina of the spine. The deep primary flexors and lateral flexors of the neck (longus colli, longus capitis, and scalenes), discussed in this chapter, are highly important to isolate and treat as it is *these* muscles that cause the majority of chronic neck and upper-extremity pain associated with loss of cervical curve. Treating the superficial muscles first and then the deeper primary flexors will allow for easier access into the deeper levels toward the vertebral bodies of the spine.

Chasing a client's pain (i.e., treating only where it hurts) often produces only temporary results. As stated above, the majority of people's pain is located in the back of the neck because of straightening of the spine and often a downward collapsed, stooped posture. Therefore, treating the secondary contractors, the ones resisting the primary contractors, will loosen them up only temporarily, and this will then cause the deeper anterior muscles to shorten even more, as they take up slack. Much of the time, it will even cause the pain to actually get worse. Treating the anterior neck muscles and then releasing the posterior suboccipitals will provide many positive benefits, such as restoring cervical lordosis, decompressing the spinal disks, putting the neck and head back on the proper plane (viewed from the side, ear over shoulder), freeing up the C1 and C2 suboccipital joints, and decreasing the intensity and frequency of the neck pain. Quite often, lengthening the hamstrings and abdominal muscles alone will upright the body significantly, thereby decreasing the cervical pain symptoms considerably.

STERNOCLEIDOMASTOID, FIGURES 7.42 AND 7.43

ORIGIN 1. Manubrium of the sternum; 2. medial clavicle

INSERTION Mastoid process

ACTION *Bilateral:* flexion of neck; elevation of sternum on deep inspiration

Unilateral: lateral flexion of neck; rotation of head to opposite side

MYOTOME C3, C4

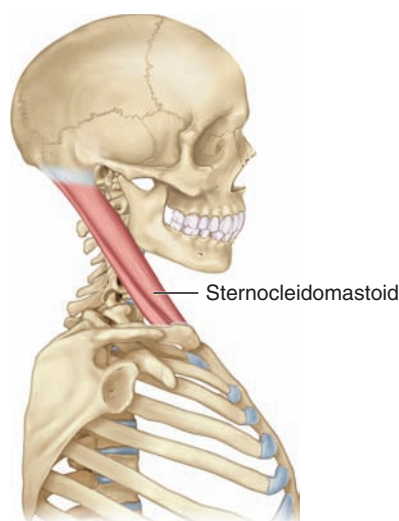


FIGURE 7.42 **Sternocleidomastoid Muscle**

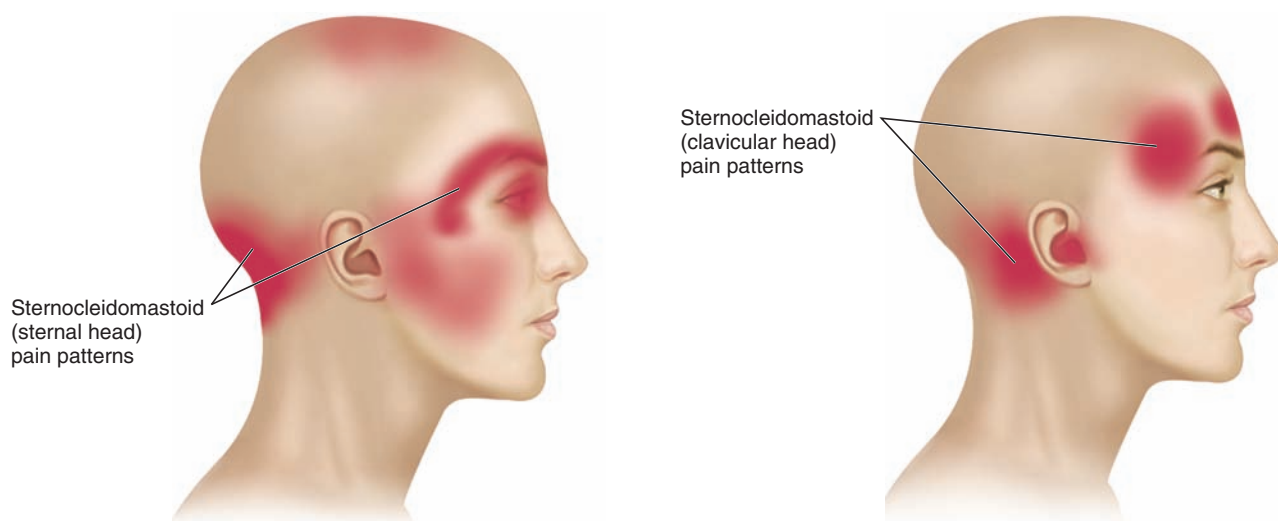


FIGURE 7.43 **Sternocleidomastoid Referred Pain Patterns**

CLINICAL NOTES: Sternocleidomastoid

The sternocleidomastoid muscle (SCM) is the largest and most superficial muscle of the antero-lateral aspect of the neck. The SCM has two distinct sections, sternal and clavicular, that merge approximately halfway to a common attachment on the mastoid process of the temporal bone. The sternal section originates on the manubrium of the sternum; the clavicular section originates 1 inch laterally on the clavicle. The clavicular section is wider, thicker, deeper, and harder to palpate.

The SCM muscles are synergistic and antagonistic to themselves. Bilaterally, they flex the neck and act as elevators of the upper thorax on forced inspiration. Unilaterally, the SCM rotates the head toward the opposite side. Working together as a unit, the SCM and trapezius muscles laterally flex the neck, drawing the ear down to the shoulder of the same side. Common distortions such as

depressed or elevated shoulder girdles, leg-length deviations, and pelvic distortions can cause these muscles to work overtime to compensate.

Pain patterns of the SCM muscle frequently include multiple referral zones to the face and head. Referral pain from the clavicular section may occur independently of referral pain from the sternal section. Trigger points in the sternal section of the SCM typically cause migraine arc pain above the eyes that travels laterally through the sinuses and spills downward to the face, cheek, and temporomandibular joint region. A person with these symptoms may also be medically diagnosed with atypical facial neuralgia or tension headache. Trigger points of the clavicular section of the SCM typically refer pain deep within the ear and may cause dizziness, disturbed equilibrium, and vertigo.

Treatment of the SCM should include restoring an upright body posture and treating any and all muscles that restrict full cervical range of motion. A treatment plan should also include daily stretching and range-of-motion exercises as well as proper evaluation and correction of postural supports. This may include adequate head, neck, and lumbar support and/or a good pillow for sleeping. Elimination of excessive neck rotation and forward head positioning is crucial for maintaining stability and strength of the neck muscles.

ROUTINE: Sternocleidomastoid

Position of client: supine. Stand or sit at the head of the therapy table.

1. Using the fingers, glide in a superior direction and explore the intermuscular septum between the sternal and clavicular divisions of the SCM muscle. With the fingers pointing inward, treat the intermuscular septum on the medial and lateral borders of the SCM. (See Figure 7.44.)
2. Using flexed fingers of both hands, penetrate under the lateral borders of the SCM's and apply light, static compression onto the anterior tubercles of the spine moving in 1-inch segments. These compressions are for examining and treating the deeper neck flexors that lie and attach under the SCM's. This examination will reveal the amount of tautness within the SCM's and the deeper flexors of the cervical spine. The amount of tautness revealed, will determine the amount of time needed for treatment. (See Figure 7.45.)
3. Isolate the sternal head of the SCM. Pick up and compress the fibers, moving superiorly in 1-inch segments. (See Figure 7.46.)

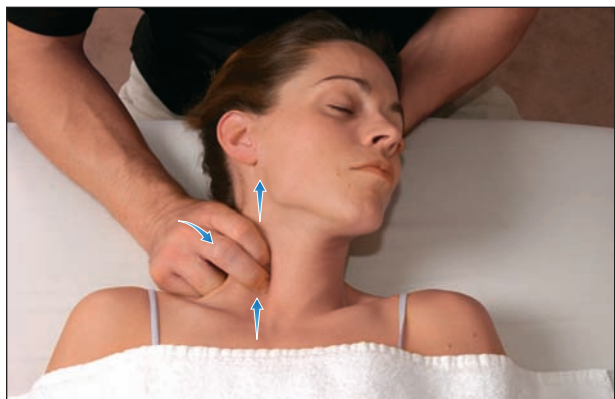


FIGURE 7.44



FIGURE 7.45

4. Isolate the clavicular head of the SCM. Pick up and compress the fibers, moving superiorly in 1-inch segments. Using one hand, cradle the client's head, rotate it away from the treatment side, and lift it toward the ceiling at a 45-degree angle. (See Figure 7.47.)
5. Using the fingertips of the other hand, rake into the SCM fibers beginning at the merge of the two heads, approximately two-thirds up the muscle. Glide superiorly up to and over the mastoid process. This will ensure a thorough treatment to the deep fibers that could be harboring trigger points and would likely not have been isolated using standard compression. (See Figure 7.48.) Glide 6 to 10 times.
6. Using a contoured index finger, friction the mastoid process in all directions. (See Figure 7.49.)



FIGURE 7.46

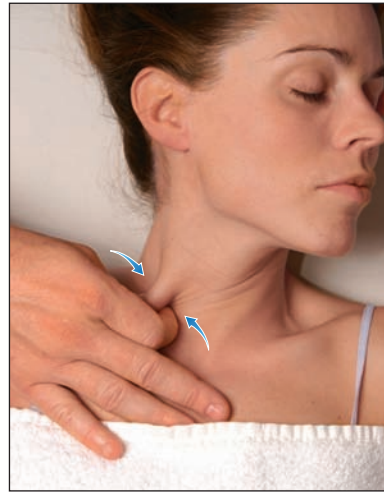


FIGURE 7.47



FIGURE 7.48a

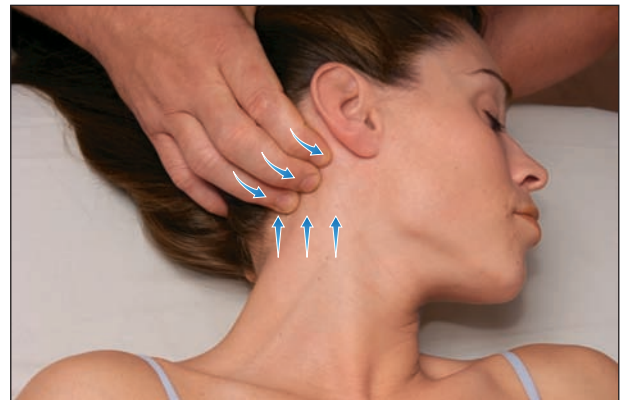


FIGURE 7.48b



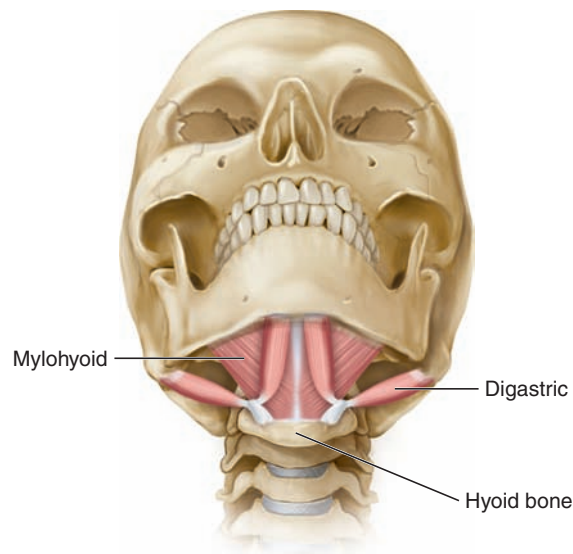
FIGURE 7.49

ANTERIOR CERVICALS—SUPERFICIAL: SUPRAHYOIDS**MYLOHYOID,** FIGURES 7.50 AND 7.51

ORIGIN	Inside surface of mandible
INSERTION	Hyoid bone
ACTION	Elevates hyoid bone; raises floor of mouth and tongue
MYOTOME	C1–C3, facial nerves

DIGASTRIC, FIGURES 7.50 AND 7.51

ORIGIN	Inside surface of mandible; mastoid process of temporal bone
INSERTION	Intermediate tendon attached to hyoid bone and inside surface of mandible
ACTION	Raises hyoid bone; assists in opening jaw; moves hyoid bone forward or backward
MYOTOME	C1–C3, facial nerves

FIGURE 7.50 **Anterior Cervicals—Suprahyoid Muscles: Mylohyoid and Digastric**

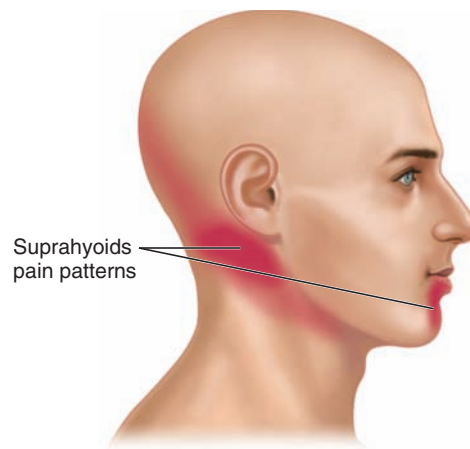


FIGURE 7.51 **Suprahyoid Referred Pain Patterns**

ANTERIOR CERVICALS—SUPERFICIAL: INFRAHYOIDS

GENIOHYOID, FIGURE 7.52

ORIGIN	Inside surface of mandible
INSERTION	Hyoid bone
ACTION	Protracts hyoid bone and tongue
MYOTOME	C1–C3, facial nerves

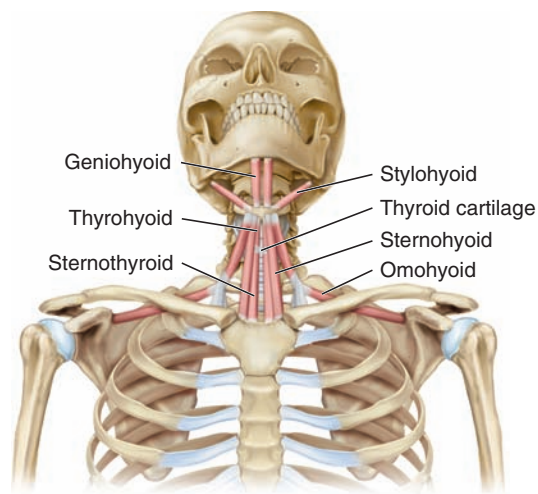


FIGURE 7.52 **Anterior Cervicals—Infrahyoid Muscles: Geniohyoid, Stylohyoid, Thyrohyoid, Sternohyoid, Sternothyroid, and Omohyoid**

STYLOHYOID, FIGURE 7.52

ORIGIN	Styloid process of temporal bone
INSERTION	Hyoid bone
ACTION	Retracts hyoid bone; elevates tongue
MYOTOME	C1–C3, facial nerves

THYROHYOID, FIGURE 7.52

ORIGIN	Lamina of thyroid cartilage
INSERTION	Hyoid bone
ACTION	Depresses hyoid or elevates thyroid cartilage
MYOTOME	C1

STERNOHYOID, FIGURE 7.52

ORIGIN	Medial end of clavicle, manubrium of sternum
INSERTION	Hyoid bone
ACTION	Depresses hyoid
MYOTOME	C1–C3

STERNOTHYROID, FIGURE 7.52

ORIGIN	Manubrium of sternum
INSERTION	Lamina of thyroid cartilage
ACTION	Depresses hyoid or depresses thyroid cartilage
MYOTOME	C1–C3

OMOHYOID, FIGURE 7.52

ORIGIN	Superior border of scapula near scapular notch
INSERTION	Hyoid bone via central tendon on clavicle
ACTION	Depresses hyoid bone
MYOTOME	C2, C3

ANTERIOR CERVICALS—DEEP

LONGUS COLLI, FIGURES 7.53 AND 7.54

ORIGIN	Multiple attachments from C3–T2 vertebral bodies and transverse tubercles
INSERTION	Multiple attachments from C3–T2 vertebral bodies and transverse tubercles
ACTION	Flexes cervical spine
MYOTOME	C2–C7

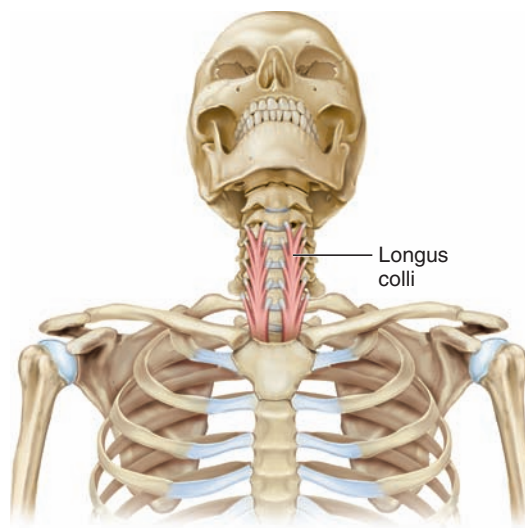
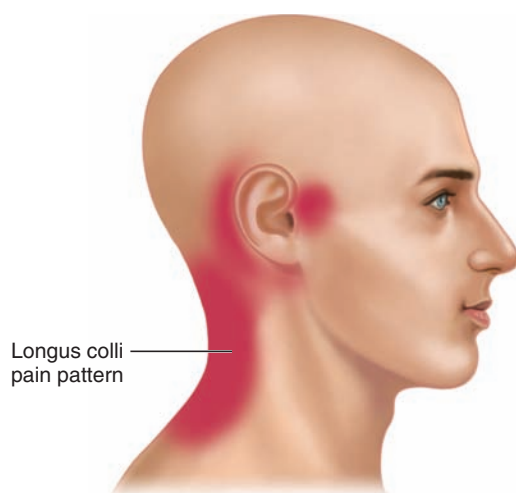


FIGURE 7.53 **Anterior Cervicals—Longus Colli Muscles**

FIGURE 7.54 **Anterior Cervicals—Longus Colli Referred Pain Pattern**

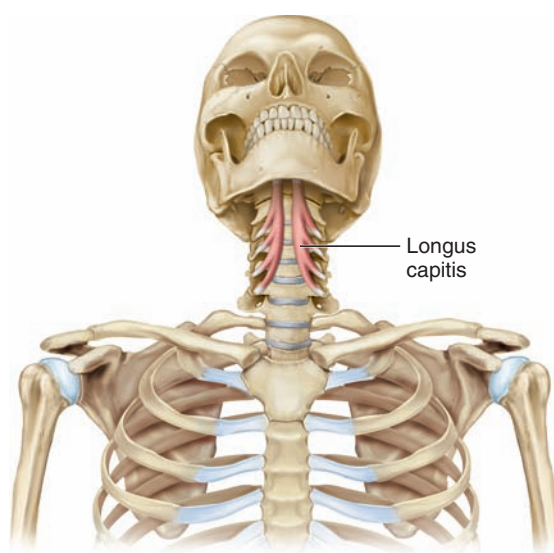
LONGUS CAPITIS, FIGURES 7.55 AND 7.56

ORIGIN Transverse tubercles of C3–C6

INSERTION Occipital bone, anterior to foramen magnum

ACTION Flexes head

MYOTOME C1–C3

FIGURE 7.55 **Anterior Cervicals—Longus Capitis Muscles**

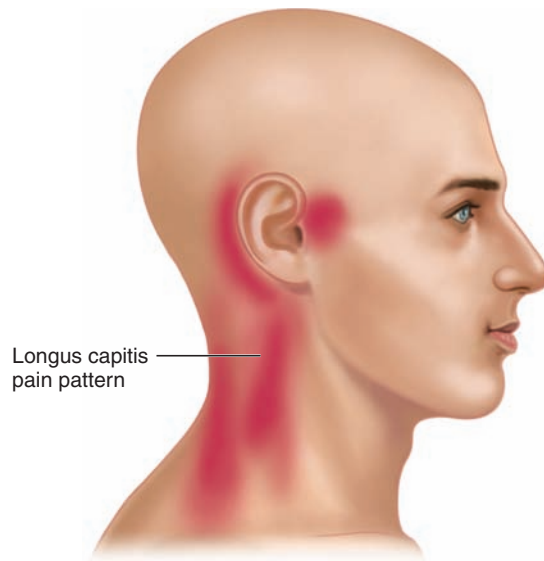


FIGURE 7.56 **Anterior Cervicals—Longus Capitis Referred Pain Pattern**

CLINICAL NOTES: Anterior Cervicals

The superficial anterior cervical muscles include the suprahyoids and the infrahyoids, which attach to multiple attachments ranging from the hyoid bone and mandible (inner surface) to the mastoid process, styloid process, thyroid cartilage, manubrium of the sternum, and scapula (superior scapular notch). The longus capitis and longus colli run deep to all of these, with attachments from the occipital bone to T2. The suprahyoids and infrahyoids influence movement of the hyoid. The longus colli and longus capitis muscles are the prime flexors of the neck and head and are frequently the root cause of neck pain and cervical joint restriction. The longus colli and longus capitis connect the head to the upper thoracic spine and initially shorten when the space between the pelvis and the rib cage shortens. This all, of course, stems from short hamstrings posteriorly rotating the pelvis—flattening the lumbar spine—and the abdominals shortening the rib cage and collapsing it forward, causing stooped posture and FHP. As the neck and head get pulled forward and down, the posterior suboccipitals countertighten, rocking the head back upright and leveling the eyes to the horizon. The farther the neck and head project forward and down, the more compression occurs at the C1 and C2 joints, thereby restricting cervical motion. When the longus colli and capitis shorten, hyperextension becomes restricted and painful. Shortening of the longus colli and longus capitis that flexes the spine and head has the direct ability to shorten the spaces between the vertebral bodies and compress the lower cervical disks. Arthritic spurring and disk degeneration can be the result of chronic hypertonicity of these muscles. If pain is chronic and persistent, or motor weakness, burning, tingling, or numbness is experienced, or radiating pain refers down the arm, it is good practice to refer the client to his primary care physician for a complete diagnostic evaluation.

Throat pain, difficulty swallowing, and the feeling of a “knot” in the throat are some symptoms of chronic shortening and/or improper healing after an injury of the anterior cervicals. When a person

sustains a whiplash injury, small micro-tears can occur in these muscles. A cervical strain or sprain is the common diagnosis. Quite frequently, whiplash injuries, especially those that occur when a person gets hit from behind, will cause the head to buckle back, straining the anterior cervical muscles. In response, the muscles spasm straightening the cervical curve. Quite often, the deep anterior neck flexors go untreated, and the body heals in a straight and sometimes reversed position. The anterior cervicals should be addressed in treatment to avoid healing in a locked-short position. The anterior cervicals should always be examined and treated when there has been surgical intervention (e.g., disk surgery or tracheotomy).

Include the suprahyoids and infrahyoids in the treatment plan. It is necessary to thoroughly release these muscles before attempting to displace the trachea and treat the longus colli and longus capitis.

ROUTINE: Anterior Cervicals

Position of client: supine.

1. Treat the fascia of the anterior and lateral neck for 5 minutes. Use fascial stretching and rolling techniques. (See Figure 7.57.) (The musculature thickens as multiple tendons merge in a 1-inch diameter in the area of the 1st cervical vertebrae and mastoid and styloid processes.) Using the index finger, treat the fascia in and around the ear with friction. Displace the ear to thoroughly treat the mastoid process and cranial fascia throughout the occipital and temporal bones.
2. Assess the tension of the suprahyoids and infrahyoids by gently moving the trachea and hyoid bone back and forth. (See Figure 7.58.)
3. Isolate the sternohyoid and sternothyroid by picking up these superficial muscles at midline. Using the fingertips and thumbs, treat the muscles from superior to inferior with compression and friction. (See Figure 7.59.)



FIGURE 7.57

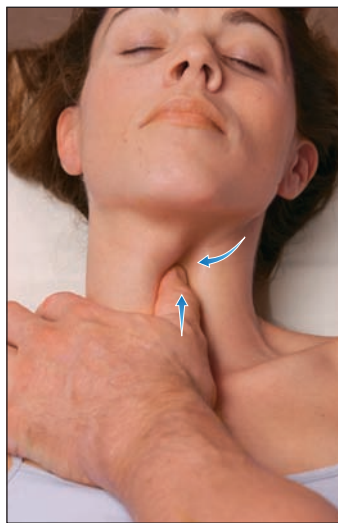


FIGURE 7.58

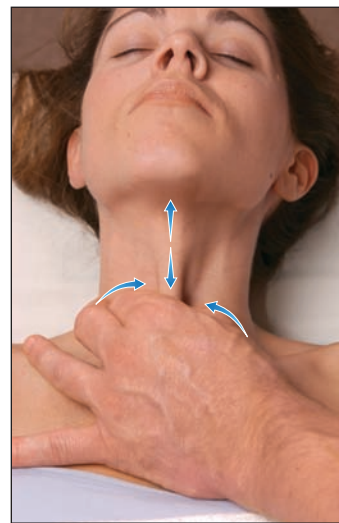


FIGURE 7.59

4. Stabilize the trachea and hyoid bone with one hand. Using the index finger of the other hand, treat the infrahyoid muscles on the cartilaginous portion of the trachea from lateral to medial with cross-fiber friction. Continue cross-fiber friction moving in a superior direction. Isolate the tracheal notch and hyoid bone. Continue treatment from lateral to medial until the entire surface of the hyoid bone is treated. Using a flexed index finger, treat underneath the hyoid bone with friction. (See Figure 7.60.)
5. Using the fingertips, treat the attachments of the suprahyoids directly above the hyoid bone from lateral to medial with cross-fiber friction. (See Figure 7.61.) Compressions should be made slowly and precisely for ensuring client's comfort. Utilize the "minimum" edge technique when treating the deeper anterior muscles of the neck. No pain means more gain.

A slight cervical extension will allow easier access to and better treatment of the longus colli and longus capitis muscles. (See Figure 7.62.)

6. To treat the longus capitis, it is necessary to displace the trachea. This is a bilateral treatment. To treat the client's left side, anchor the left index finger on the right side of the client's mandible and move the trachea with the left thumb. If the skin is too taut to penetrate after moving the trachea to one side, try gathering some connective tissue toward the side being treated before displacing the trachea. (See Figure 7.63.)
7. Stabilize the trachea in its displaced position with the left thumb. Using the right thumb or index finger, compress the longus colli and longus capitis muscles against the anterior vertebral bodies and cervical disks. (See Figure 7.64.)
8. Using both index fingers, effleurage the longus colli and longus capitis muscles just lateral to the midline. (See Figure 7.65.)
9. Using the right thumb or index finger, treat the anterior longitudinal ligament, longus colli, and longus capitis with cross-fiber friction. (See Figure 7.66.) This is done with a focused intent and should not be painful.

Position: Change direction and stand at the head of the table.

10. Lift the client's head, and flex the neck and head forward. With the left thumb or index finger, compress and hold static compression to the longus colli and longus capitis muscles from the midline to the anterior tubercles, increasing the cervical extension with each compression. (See Figure 7.67.)
11. After treating the superficial and deep anterior cervical muscles, stretch the muscles by cupping the hands under the neck at the lowest level of C7 and T1. Pull the cupped hands toward the ceiling, and stretch the anterior



FIGURE 7.60

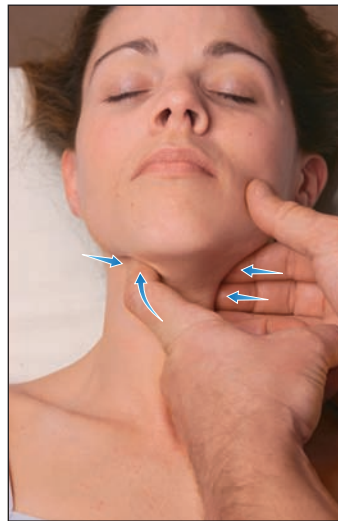


FIGURE 7.61



FIGURE 7.62

cervical muscles. This specific stretch will assist in restoring the cervical curvature, as well as decreasing the compression effect on the cervical disks. (See Figure 7.68.) This is a slow, non-forceful stretch. The client should experience no pain when administering this stretch. Stretching while maintaining the client's "minimal" edge will assure no discomfort to the client; it is the client who lets go, not the therapist forcing the stretch.

12. Repeat steps 6 to 11 on the client's right side.



FIGURE 7.63

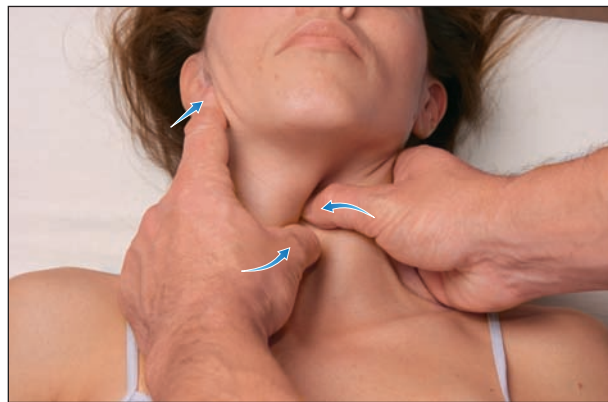


FIGURE 7.64

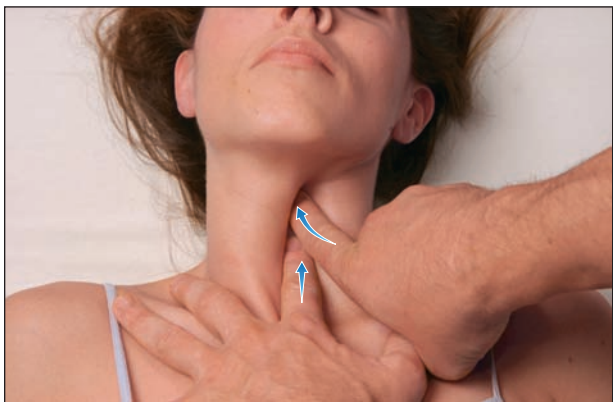


FIGURE 7.65

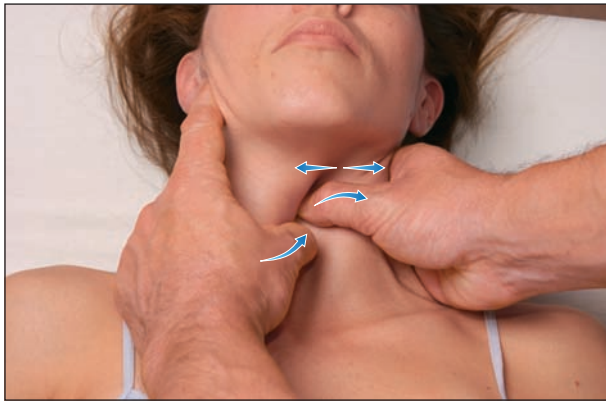


FIGURE 7.66

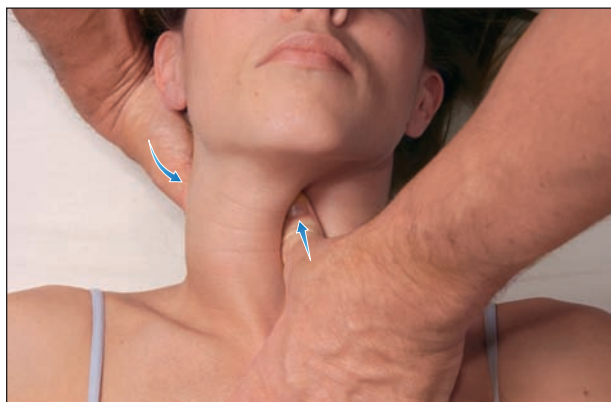


FIGURE 7.67

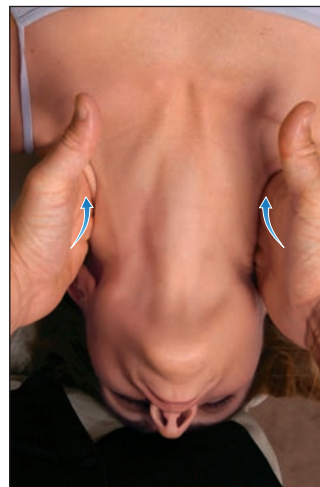


FIGURE 7.68

SCALENES

SCALENUS ANTERIOR, FIGURES 7.69 AND 7.70

ORIGIN Anterior tubercles of cervical vertebrae C3–C6

INSERTION 1st rib

ACTION Flexion and lateral flexion of neck; rotation of neck; elevation of 1st rib on deep inspiration

MYOTOME C3–C5

SCALENUS MEDIUS, FIGURES 7.69 AND 7.70

ORIGIN Anterior tubercles of cervical vertebrae C2–C7

INSERTION 1st rib

ACTION Flexion and lateral flexion of neck; rotation of neck; elevation of 1st rib on deep inspiration

MYOTOME C3–C5

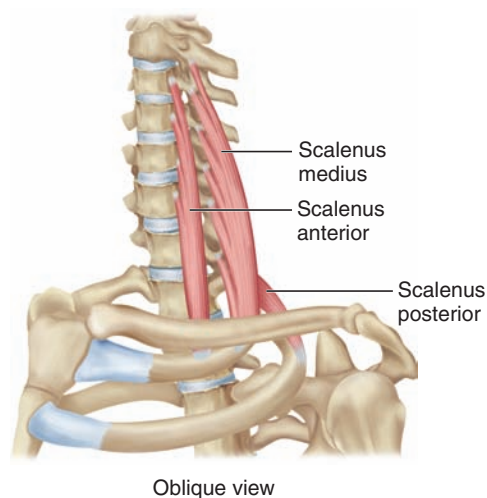
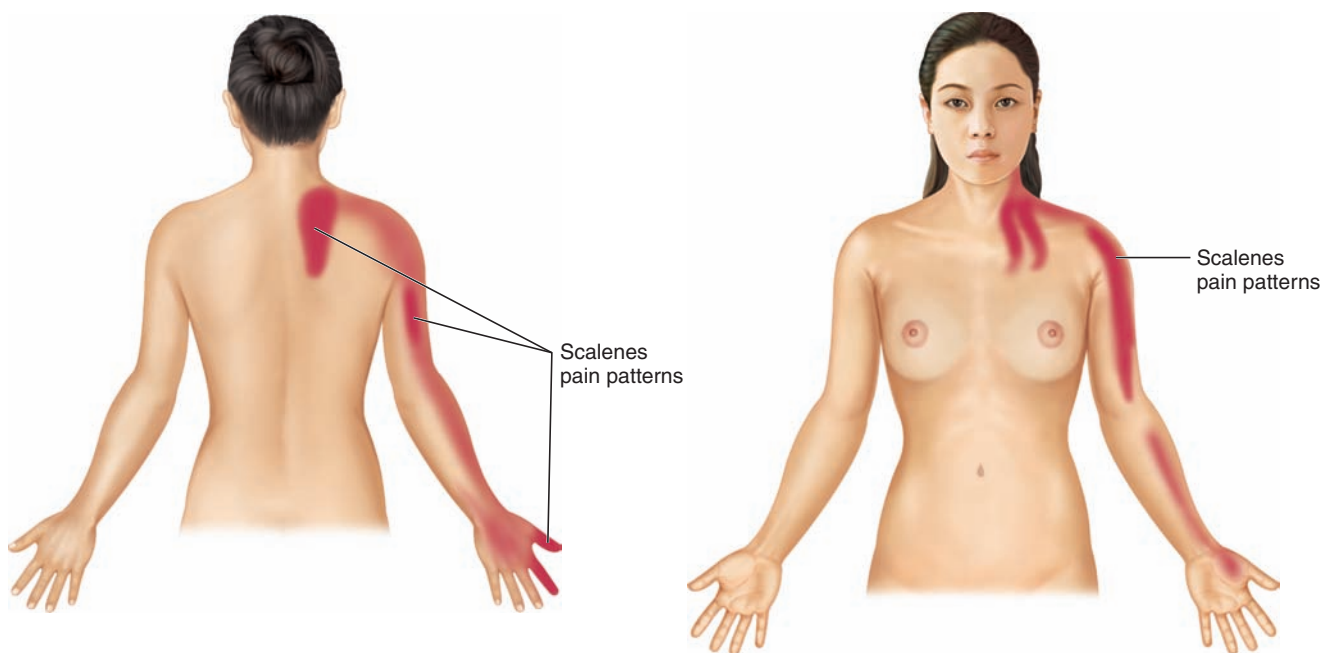


FIGURE 7.69 **Scalene Muscles: Scalenus Anterior, Scalenus Medius, and Scalenus Posterior**

FIGURE 7.70 **Scalene Referred Pain Patterns**

SCALENUS POSTERIOR, FIGURES 7.69 AND 7.70

ORIGIN Posterior tubercles of cervical vertebrae C5–C7

INSERTION 2nd rib

ACTION Flexion and lateral flexion of neck; rotation of neck; stabilization of base of neck; raises 2nd rib on deep inspiration

MYOTOME C3–C5

CLINICAL NOTES: Scalenes

The scalene muscle group originates on the cervical vertebrae and inserts on the 1st and 2nd ribs. Acting unilaterally, the scalene muscles serve as prime movers for lateral flexion of the cervical spine. Acting bilaterally, the scalenes assist the longus colli in neck flexion. The scalenes also participate in neck rotation and respiration.

In most conventional medical practices, the scalene muscle group is often overlooked as a source of pain along the upper vertebral border of the scapula and upper extremity. Although the primary symptom of a hypertonic scalene muscle is myofascial pain, according to Travell (whose nickname

for the scalene muscles is “entraper”), symptoms arising from ischemic and hypertonic scalene muscles can perpetuate neurovascular and brachial plexus entrapment. Neurovascular entrapment and/or compression can produce pain and swelling of the entire upper extremity, including the hand and fingers.

Chronic unilateral contraction of the scalene muscles is primarily due to asymmetry elsewhere in the body, such as leg-length deviation, pelvic distortion, scoliosis, or a tilted shoulder girdle.

ROUTINE: Scalenes

Note: If the client experiences an electriclike shock during this treatment, reposition the flexed fingers on the posterior tubercles. An electriclike shock is a neurologic sign that an intrusion has occurred on the nerve roots of the brachial plexus that exit the spine between the anterior and posterior tubercles.

Position of client: side-lying, with the client’s arm extended. (See Figure 7.71.) This position ensures that the clavicle is off the rib cage and that the scalene muscles are exposed for treatment. Stand behind the client, and use both hands to reach over the client’s body in the proximity of the cervical spine.

1. Using one hand, grasp the SCM muscle and move it toward the therapy table. Using the other hand, penetrate under the SCM muscle, moving medially until the anterior vertebral bodies are reached. Using the fingertips, treat the attachments of the anterior scalene on the tubercles with compression and slow subtle friction from C3 to C7. (See Figure 7.72.)
2. Using the fingertips, continue the compressions and friction, moving posteriorly approximately $\frac{1}{4}$ inch to $\frac{1}{2}$ inch to treat the medial and posterior scalene attachments on the anterior and posterior tubercles.
3. Using the fingertips, penetrate under the clavicle as far inferior as possible to influence the deeper fibers of the scalenes toward the 1st and 2nd ribs. (See Figure 7.73.) Utilize the “minimum” edge to ensure client’s comfort.



FIGURE 7.71

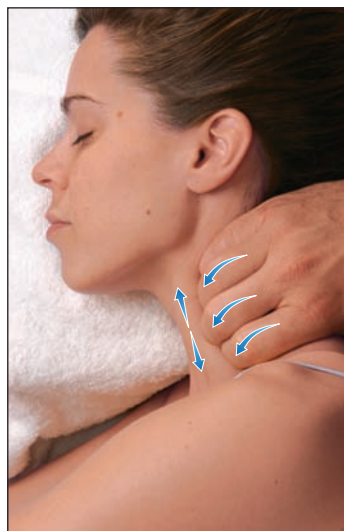


FIGURE 7.72



FIGURE 7.73

Ensure the client's comfort by treating slowly and precisely. If a pulse is palpated, reposition the fingers. A palpated pulse is a sign that the carotid artery has been penetrated. Do not stimulate these or other neurovascular structures of the body.

Position of client: supine.

Pick up the client's head and cup it in the hand. Rotate the head away from the side being treated, and elevate it approximately 45 degrees.

4. Lightly place the thumb of the other hand between the sternal and clavicular tendons of the sternocleidomastoid muscle, just above the clavicle. Using the thumb, treat the scalenes with slow, static compression. (See Figure 7.74.)
5. Continue with thumb and glide superiorly along the anterior tubercles up to the point where the heads of the SCM merge. (See Figure 7.75.)
6. Using flexed fingers, continue to treat the scalenes where they lie under the SCM muscle with compressions and 1-inch glides. (See Figure 7.76.) Release the compression, move, then reenter with compression, and continue 1-inch glides until the entire scalene attachments and bellies have been treated.



FIGURE 7.74

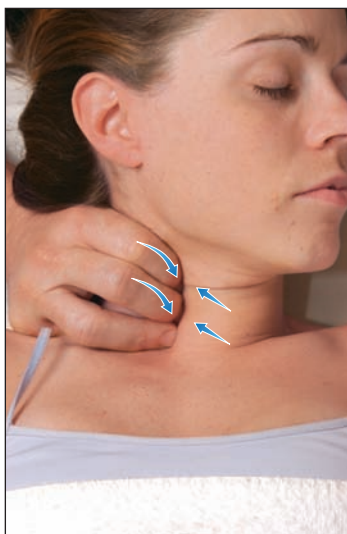


FIGURE 7.75

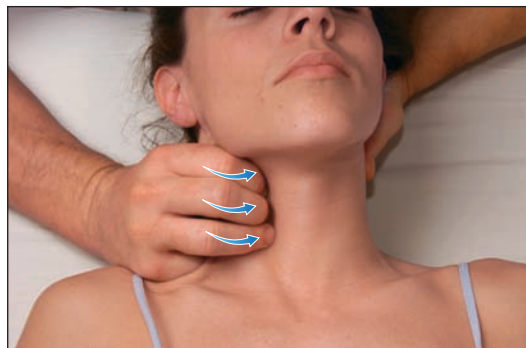


FIGURE 7.76

TEMPOROMANDIBULAR JOINT

MASSETER, FIGURES 7.77 AND 7.78

ORIGIN	Zygomatic arch
INSERTION	Angle of mandible (outer surface)
ACTION	Closes lower jaw; clenches teeth
MYOTOME	5th cranial nerve (trigeminal)

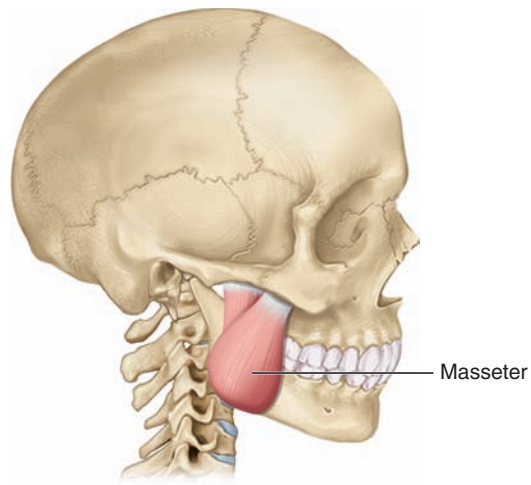


FIGURE 7.77 **Masseter Muscle**

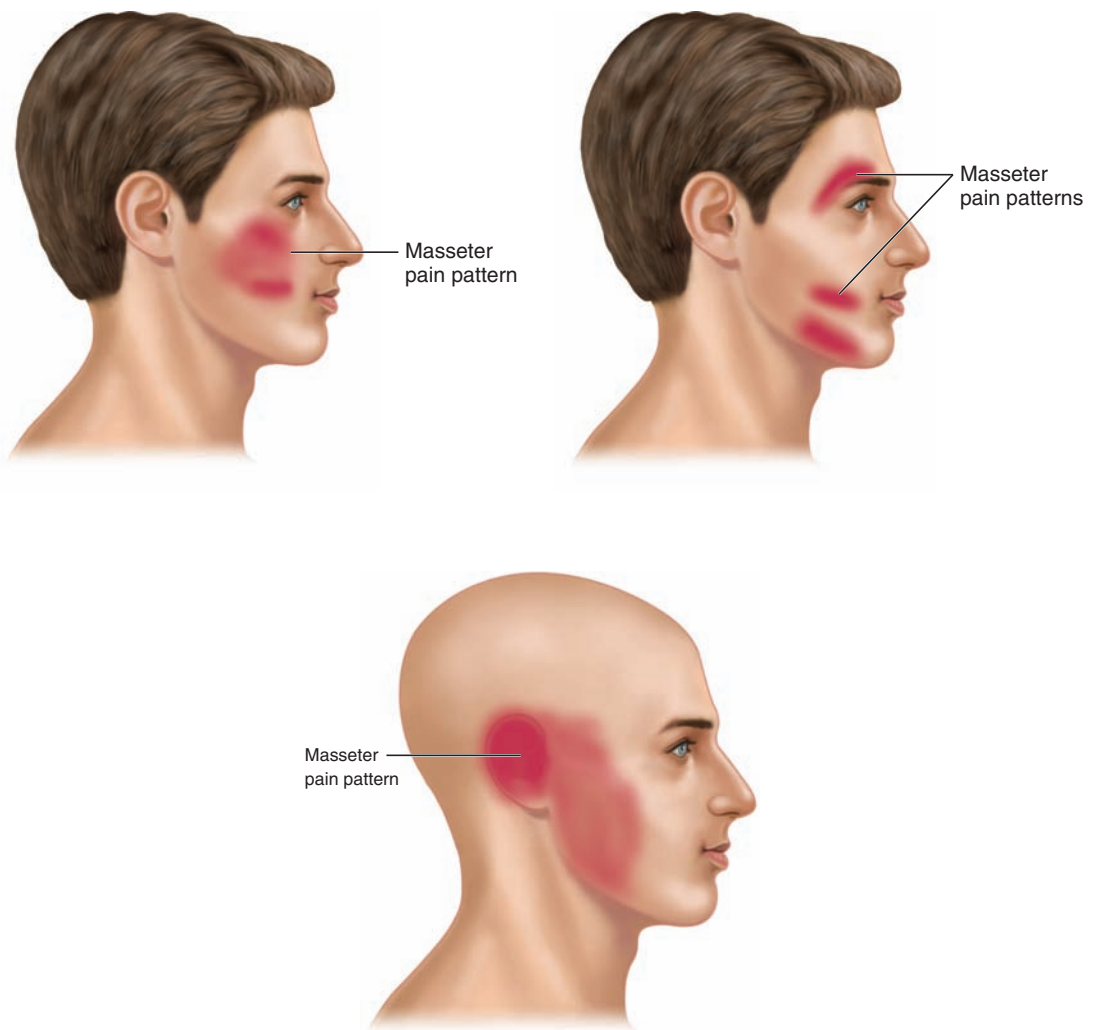


FIGURE 7.78 **Masseter Referred Pain Patterns**

TEMPORALIS, FIGURES 7.79 AND 7.80

ORIGIN	Temporal bone
INSERTION	Coronoid process of mandible
ACTION	Closes jaw; clenches teeth
MYOTOME	5th cranial nerve (trigeminal)

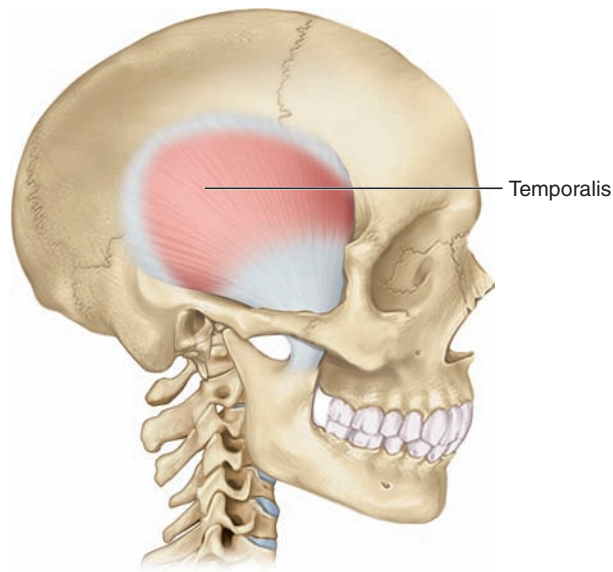


FIGURE 7.79 **Temporalis Muscle**

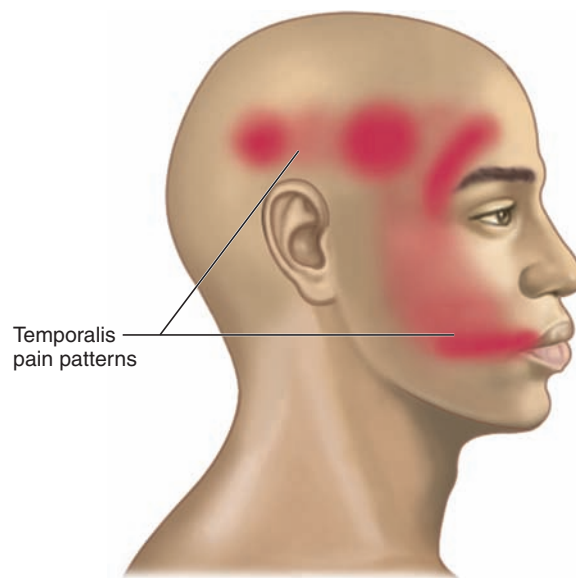


FIGURE 7.80 **Temporalis Referred Pain Patterns**

MEDIAL PTERYGOID, FIGURES 7.81 AND 7.82

ORIGIN	Medial pterygoid plate of sphenoid bone
INSERTION	Angle of mandible (inner surface)
ACTION	Closes lower jaw; clenches teeth; deviates jaw to opposite side
MYOTOME	5th cranial nerve (trigeminal)

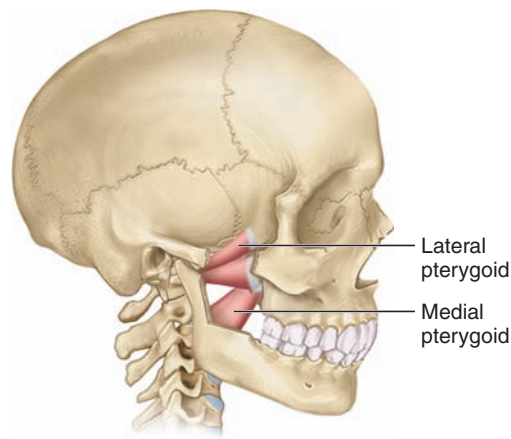


FIGURE 7.81 **Pterygoid Muscles: Medial and Lateral**

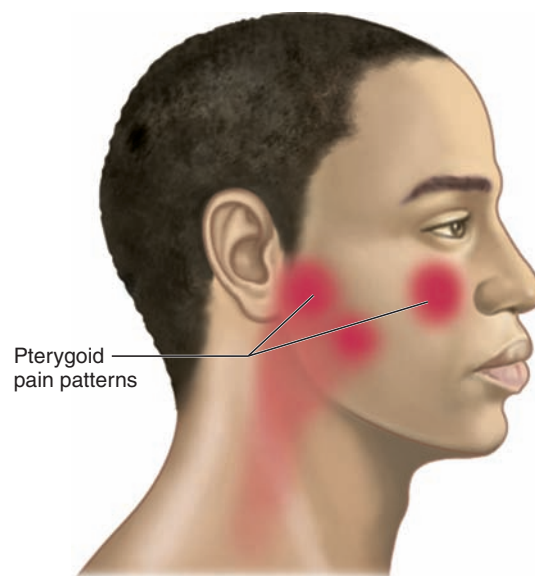


FIGURE 7.82 **Pterygoid Referred Pain Pattern**

LATERAL PTERYGOID, FIGURES 7.81 AND 7.82

ORIGIN	Lateral pterygoid plate of sphenoid bone
INSERTION	Mandibular condyle, temporomandibular joint capsule, and articular disk
ACTION	Opens jaw; protracts mandible; deviates jaw to opposite side
MYOTOME	5th cranial nerve (trigeminal)

CLINICAL NOTES: Temporomandibular Joint

The temporomandibular joint (TMJ) is the articulation between the condyle of the mandible and the squamous portion of the temporal bone. It is the only bilateral joint in the body. The masseter, temporalis, medial pterygoid, and lateral pterygoid contribute to its function and facilitate the opening and closing of the jaw.

All of these muscles attach to the mandible and influence its movement. The masseter, medial pterygoid, and temporalis muscles are responsible for elevating the mandible and enabling jaw closure, while the lateral pterygoid depresses and protracts the mandible to open the mouth. Acting unilaterally, the medial and lateral pterygoid muscles move the jaw to the opposite side, while the masseter muscle facilitates movement of the jaw to the same side.

Symptoms of TMJ dysfunction include ear pain, sore jaw muscles, temple and/or cheek pain, jaw popping or clicking, difficulty opening the mouth fully, and frequent headaches and/or neck aches. The sternocleidomastoid and trapezius muscles also commonly trigger pain throughout the head, face, and jaw. This can perpetuate a secondary reflex arc of the temporalis, masseter, medial pterygoid, and lateral pterygoid muscles. Rule out trigger points from the SCM and trapezius before treating the TMJ musculature.

A therapist and a dentist should work together to address TMJ dysfunction so that the dental and neuromuscular components can be understood and properly treated. TMJ pain and dysfunction could be a result of a range of problems including occlusal disharmony from improper-fitting dentures and crowns, long dental procedures, excessive gum chewing, bruxing (grinding and clenching teeth), direct trauma, anxiety, emotional tension, and chronic improper head and body posture.

When the mouth is opened, the mandibular condyles should translate forward and downward; this simultaneous movement should be fluid and imperceptible. Crackling, clicking, and popping noises may indicate internal derangement of the articulating disk and can lead to muscular tension and pain. Hypertonicity of the lateral pterygoid muscle can actually pull the articulating disk of the TMJ forward, rupturing the posterior retrodisk tissues. Occlusal splint therapy and/or TMJ surgery may be indicated to correct this kind of TMJ dysfunction.

ROUTINE: Temporomandibular Joint

Position of client: supine.

1. Treat the cranial fasciae for approximately 10 minutes. Use a hair-pulling technique utilizing traction and/or thumb compression with friction. Release the layers of fasciae that swirl in and around the ears and TMJ. (See Figures 7.83 and 7.84.)
2. With one hand, rotate the client's head away from the side of treatment. Using flexed fingertips, treat the entire temporalis muscle with circular friction. Friction above and below the zygomatic arch. (See Figure 7.85.)
3. Isolate the temporalis tendon where it inserts on the coronoid process. To do this, have the client open her mouth to expose the temporalis tendon under the zygomatic arch. Treat the muscle and tendon slowly with cross-fiber friction. Use caution—this area can be highly sensitive. Utilize the “minimal” edge technique to ensure the client's comfort (See Figure 7.86.)
4. Using a contoured index finger, treat the mastoid process with slow, deep friction. (See Figure 7.87.)

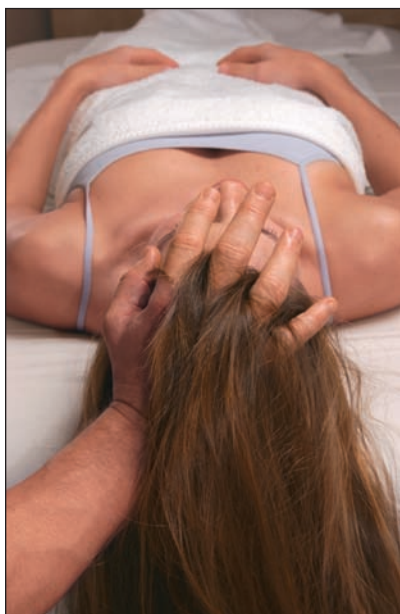


FIGURE 7.83



FIGURE 7.84

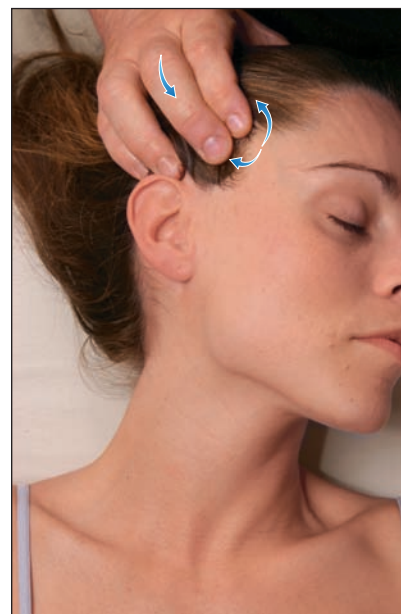


FIGURE 7.85

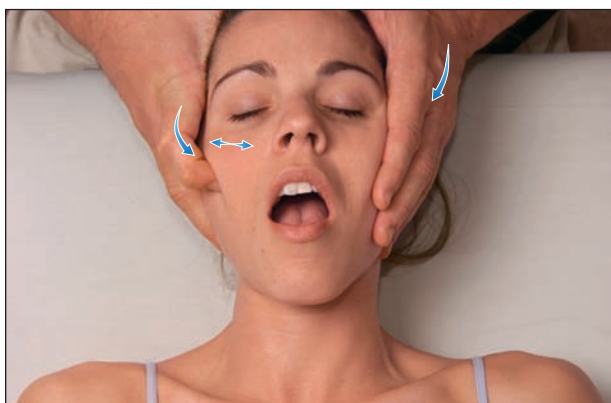


FIGURE 7.86

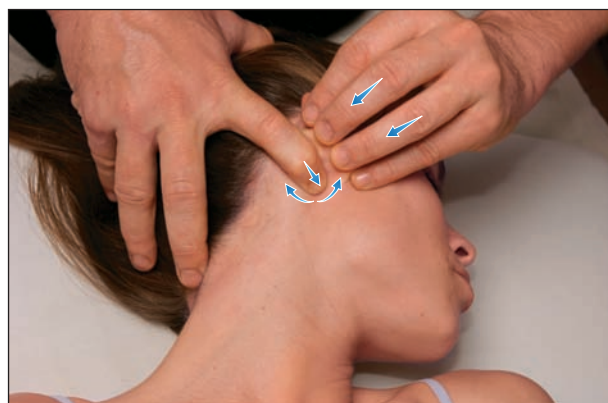


FIGURE 7.87

5. Using the thumb, effleurage the entire masseter muscle from the zygomatic arch to the angle of the mandible.
6. Using the thumb, friction the attachments of the masseter on the zygomatic arch and the angle of the mandible. (See Figure 7.88.)
7. Using the thumb, again effleurage the entire masseter muscle from the zygomatic arch to the angle of the mandible. Insert the index finger into the client's mouth, staying along the inside of the cheek. (See Figure 7.89.)

Note: Before performing intraoral treatments to muscles in the mouth, check your state's regulations to ensure that these treatments are legal within the scope and practice of massage therapy. Wash your hands thoroughly, and always use a glove before administering intraoral treatments.

8. Using the index finger, penetrate laterally and inward until reaching the masseter. To confirm location of the masseter, have the client clench her jaw to contract the muscle and then release. Using the finger and thumb, treat the masseter from the zygomatic arch to the angle of the mandible with compression and friction in ½-inch sections. (See Figure 7.90.)
9. Using the pad of the thumb, apply pressure straight down toward the therapy table. Use the edge technique to penetrate the deep section of the muscle once the superficial section has been released. (See Figure 7.91.)
10. Support the client's head with the nontreating hand for stabilization. To isolate the medial pterygoid, first palpate the hamulus bone. The medial pterygoid will originate just posterior to the hamulus projection, directly behind the upper back molars. Using a flexed index finger, treat the medial pterygoid with compression into the upper fibers of the muscle and hold the pressure until the muscle releases. (See Figure 7.92.) Using a flexed index finger, glide down to the angle of the mandible.
11. Isolate the lateral pterygoid. To do this, have the client deviate the jaw toward the side of treatment so that it is possible to fit the index finger between the cheek and the upper molars, as far back as possible. Using a flexed index finger, treat the lateral pterygoid with the edge technique, using hand signals for communication. Have the client open and close the jaw several times to allow for penetration. Apply light, static compression as far up and toward the TMJ as possible. *No pain means more gain.* (See Figure 7.93.)

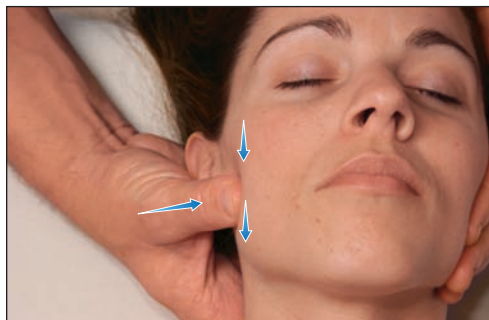


FIGURE 7.88

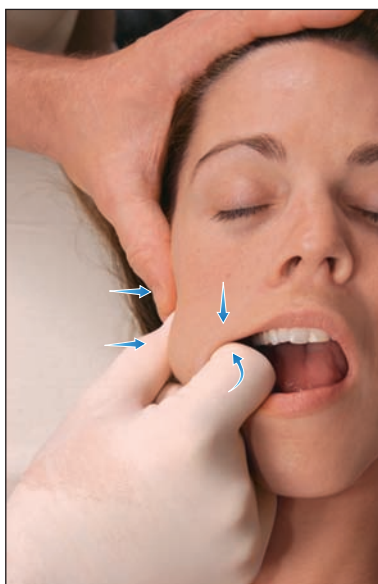


FIGURE 7.89

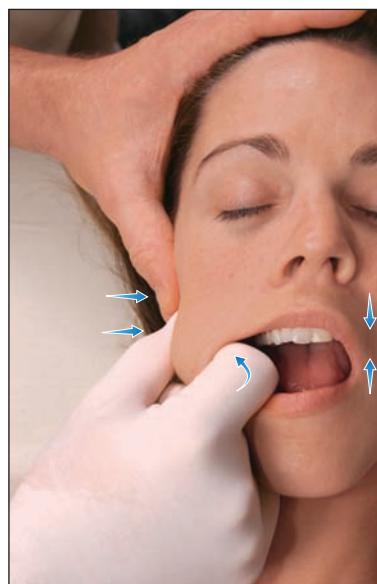


FIGURE 7.90



FIGURE 7.91

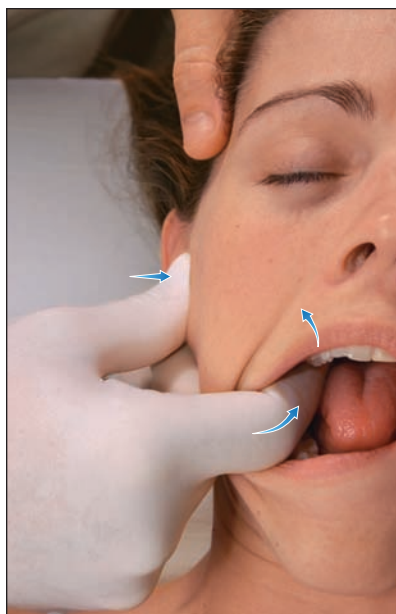


FIGURE 7.92



FIGURE 7.93

STRETCHING

Using a body ball, have the client relax and hyperextend the body over the ball, stretching the abdominals, ilio-psoas and pectorals as well as the anterior neck muscles. Stretching the anterior torso compartment should be comfortable and relaxing.



FIGURE 7.94 Relaxed anterior torso stretch (over body ball)

Using a body ball, have the client relax and hyperextend the body over the ball, stretching the abdominals, ilio-psoas and pectorals as well as the anterior neck muscles.

Stretching the anterior torso compartment should be comfortable and relaxing. Now place your hands on the lateral rib cage and assist the client by gently tractioning the rib cage in a superior direction, further assisting the stretching of the hip flexors and abdominals of the ATC.



FIGURE 7.95 Assisted complete anterior torso stretch (over body ball)

Using a body ball, have the client relax and hyperextend the body over the ball, stretching the hip flexors, abdominals, and pectorals as well as the anterior neck muscles.

Stretching the anterior torso compartment should be comfortable and relaxing. Now place your hands on the client's elbows, further assisting the stretching of the pectorals and the anterior neck muscles.



FIGURE 7.96 Assisted anterior torso stretch (over body ball)

Using a body ball, have the client relax and hyperextend the body over the ball, stretching the abdominals, iliopsoas and pectorals as well as the anterior neck muscles. Stretching the anterior torso compartment should be comfortable and relaxing. Now assist the client in lengthening and rotating the trunk. Your lower hand gently stabilizes the ilium on the ASIS (on the side on which you are standing), while your upper hand grasps the client's arm and pushes it across the body, further assisting the rotational stretch of the abdominal muscles of the ATC.



FIGURE 7.97 Assisted anterior torso stretch (over body ball)

With the client in the side-lying position and the leg flexed 90 degrees at the hip, place your upper hand across the posterior pelvis to stabilize the pelvis and place your

lower hand on the anterior lower thigh (just above the knee). Hyperextend the client's leg by pulling it back, stretching the hip flexors. Keeping the leg straight will primarily isolate the flexors of the hip, whereas flexing the knee while stretching the hip flexors will also engage the stretch to the quadriceps muscles. These stretches are highly effective and should be performed with a focused intent to ensure the quality of the stretch. Effectiveness and quality are achieved by stretching slowly while communicating with the client to maintain his comfort level. *No pain means more gain.*



FIGURE 7.98 Assisted hip flexor stretch (with rope)

This is the most effective stretch when an assistant is available to help stabilize the client's pelvis; the lower leg is flexed and supported by the assistant's thigh. This allows you to focus strictly on the client's stretch and to maneuver the leg into different positions for isolating and performing a thorough stretch of the hip flexors.



FIGURE 7.99 Two-person assisted hip flexor stretch

Stand behind the client, and stabilize one shoulder while stretching the other. Externally rotate the shoulder,

stretching the medial rotators while supporting the client's body.



FIGURE 7.100 Assisted medial rotator stretch

With the client in the standing position, instruct the client to clasp the hands around the back of the neck to support the lower cervical spine. Have the client hyper-extend and stretch the anterior cervical muscles.



FIGURE 7.101 Anterior cervical stretch

BRIEF SUMMARY

The anterior torso compartment (ATC) is a chain of connecting muscles and fasciae that arise from the pubic bone and iliac crests of the pelvis. It is a pulley system of muscles that attach the front of the pelvis to multiple attachments on the anterior rib cage. Several of the ATC muscles continue upward, making the connection to the shoulder girdles, anterior cervical spine, jaw, and skull. Postural distortions that arise from muscular imbalances of the coronal plane affect many joints, including the sacroiliac, vertebral column, rib cage, shoulder girdle, and jaw. Treatment to the ATC is delivered in sequence, with treatments starting at the abdomen and continuing to the rib cage, chest, shoulder girdle, neck, and jaw.

The Clinical Notes boxes in this chapter cover muscular imbalances that affect posture and pain. The Routine boxes and their illustrations provide guidance for proper hand placement in delivering effective therapy techniques. The Stretching box demonstrates specific stretching techniques that are safe, effective, and easy to do.

REVIEW QUESTIONS

1. Name the primary muscle that compresses the abdominal contents.

2. What is the main action of the rectus abdominis muscle?

3. The abdominal routine is one of the most important treatments for people suffering from what type of posture?

4. Name the abdominal muscle that rotates the trunk to the opposite side.

5. If a client experiences sustained pain (acute or chronic) of the abdomen, what should the massage/bodywork therapist do?

6. The iliopsoas muscle group comprises what two muscles?

7. List the three divisions of the pectoralis muscle.

8. Acting unilaterally, the sternocleidomastoid (SCM) rotates the head to which side?

9. Name the two primary flexors of the neck that are located deep within the anterior cervical region and that, when “locked short,” can straighten the cervical spine and refer pain to the back of the neck.

10. List the three primary muscles that close the jaw and clench the teeth.

CRITICAL-THINKING QUESTIONS

A client complains of occasional tingling and numbness of the fingers and a painful, weak grip.

1. What side-lying routine should the therapist consider treating first, and why?

2. Releasing and lengthening which muscles would help to restore the cervical lordosis?



CHAPTER 8
ANTERIOR LOWER-EXTREMITY
COMPARTMENT (ALEC)

LEARNING OUTCOMES

After completing this chapter, you will be able to:

- 8.1 List and identify the muscles of the ALEC.
- 8.2 Define the origins and insertions of the muscles of the ALEC.
- 8.3 Recognize the pain patterns of the ALEC.
- 8.4 Discuss the clinical notes for and the importance of treating the muscles of the ALEC.
- 8.5 Demonstrate the client positioning and treatment routines of the ALEC.
- 8.6 Demonstrate safe and effective stretching techniques for the muscles of the ALEC.

OVERVIEW

The anterior lower-extremity compartment (ALEC) is sequenced with the posterior torso compartment (PTC). This chapter, on the ALEC, and the next chapter, on the PTC, collectively address muscular imbalances and related conditions affecting the ankles, knees, and hip (ALEC) and the spine, rib cage, and scapulas (PTC). The chapters were precisely thought out and sequenced so that students will have a clear understanding and appreciation of the importance of treating these two compartments together. The muscles of the PLEC and the ATC have a significant role in many postural imbalances that cause pain, as seen in a “swayback posture.”

Repetitive ankle injuries are frequent when muscular imbalances of the inverter-everter muscles are left untreated. The peroneal muscles located on the lateral side of the leg are usually involved with strain or sprain injuries. The lateral malleolus of the fibula is the common site of soft-tissue injuries. A high injury to the quadriceps femoris group or excessive muscle tension from overloading the tensor fasciae latae muscle contributes to a majority of localized pain of the knee, thigh, and hip. There are other muscles that refer pain to the thigh, to the hip, and down the leg from other compartments as well as pathologies originating from spinal disks and from sacroiliac and spinal joint compression and fixation. They should also be considered.

The treatment routines for the ALEC will assist students in sharpening their skills so that they can deliver massage/bodywork techniques effectively and efficiently.

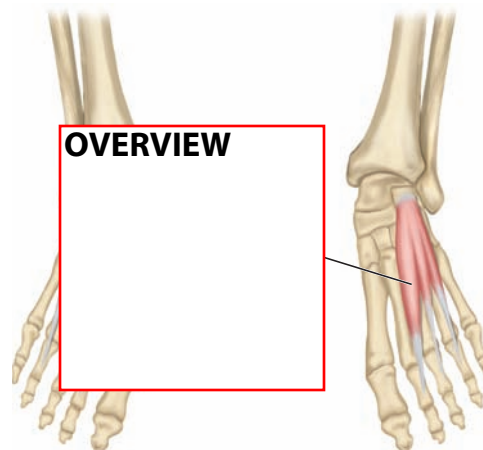
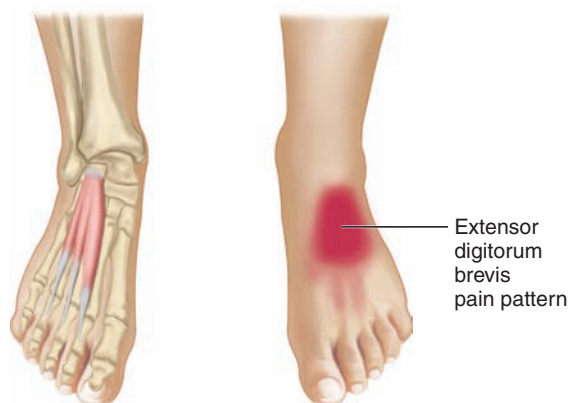
CLINICAL SUCCESS

A client complained of right medial knee pain. He was overweight and stated that the pain was from past knee surgeries, including reconstructive knee surgery to repair a torn meniscus and an anterior cruciate ligament years earlier. The client stated that he had lived with pain for many years and that it got worse in cold weather. An examination of the knee determined that scar tissue was present and that the patella was fixed. The client received a 2-hour session to determine whether the cause of the pain involved the muscles or was the result of a structural problem with the ligaments and joint.

The therapist started the session by moving the patella back and forth and side to side; however, movement to the patella was restricted. The patella was supported on each side while cross-fiber

friction was administered around the borders. The therapist used the index finger to glide and friction underneath the patella borders while staying within the client's comfort zone. After 20 minutes of deep, slow, and isolating friction, the patella glided up and down and shifted back and forth more fluidly. The client's knee was bent and bolstered. The therapist continued to isolate the medial tendons inserting on the medial and proximal shaft of the tibia; then the therapist flexed the fingers around the medial and posterior sides of the knee and raked the fingers toward the anterior side. As this was the area of complaint, time was spent isolating the individual tendons with static compression and cross-fiber friction. The quadriceps were massaged by gliding the fingertips and thumb between the intermuscular septum of each muscle, separating the muscle divisions and fascia. The adductor muscles were isolated and ischemic, so the therapist compressed and petrissaged them to increase blood flow and reduce discomfort.

The client was placed in the prone position so that the therapist could access the muscles behind the knee. With the knee flexed at 90 degrees and resting on the therapist's shoulder, the popliteus muscle was isolated utilizing compression and gliding techniques. The client was moved toward the edge of the table so that his left foot and ankle could hang freely off the end. The therapist got on the table and positioned a foot across the hamstring group to apply deep broad compression to the muscles. The therapist gradually positioned both feet on the client's right hamstrings and applied full body weight. Because the client had large legs, this technique allowed access to the deeper fibers of the muscles. At the end of the session, both the ischemia and tenderness in the leg muscles had decreased. The therapist demonstrated hamstring, adductor, and quadriceps stretches for the client and suggested that he maintain flexibility by stretching daily.

ALEC**EXTENSOR DIGITORUM BREVIS,** FIGURES 8.1 AND 8.2**ORIGIN** Anterior calcaneus**INSERTION** Bases of proximal phalanges of 2nd, 3rd, and 4th toes**ACTION** Extends 2nd, 3rd, and 4th toes**MYOTOME** L4, L5, S1FIGURE 8.1 **Extensor Digitorum Brevis Muscles**FIGURE 8.2 **Extensor Digitorum Brevis Muscle and Referred Pain Pattern**

TIBIALIS ANTERIOR, FIGURES 8.3 AND 8.4

ORIGIN Lateral condyle and shaft of tibia, interosseous membrane

INSERTION Medial side and plantar surface of medial cuneiform bone and base of 1st metatarsal bone

ACTION Dorsiflexes ankle; inverts foot

MYOTOME L4, L5, S1

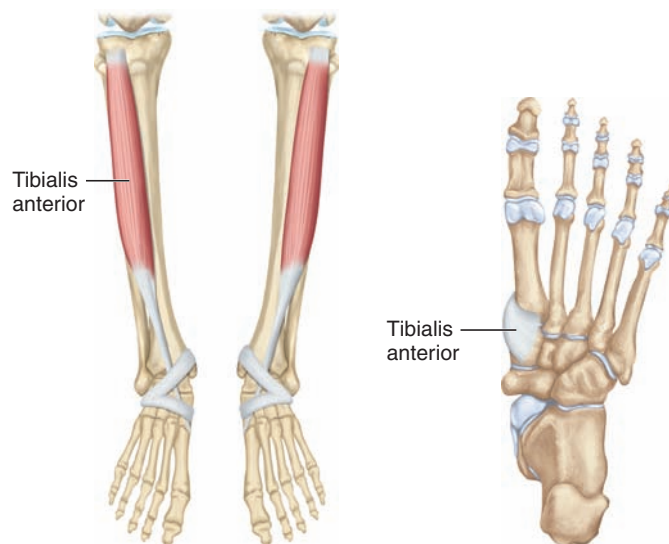


FIGURE 8.3 **Tibialis Anterior Muscles**

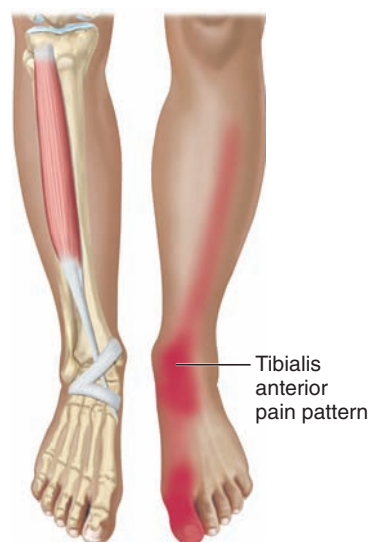


FIGURE 8.4 **Tibialis Anterior Muscle and Referred Pain Pattern**

EXTENSOR HALLUCIS LONGUS, FIGURES 8.5 AND 8.6

ORIGIN Anterior fibula and interosseous membrane

INSERTION Base of distal phalanx of great toe

ACTION Extends great toe; dorsiflexes and supinates foot

MYOTOME L4, L5, S1

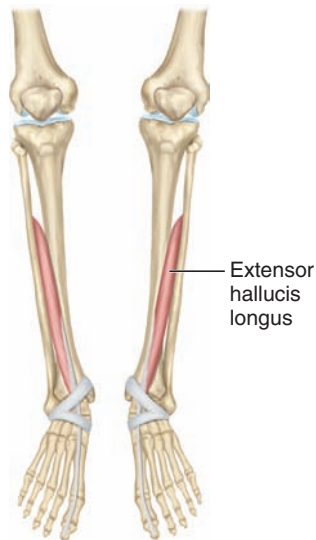


FIGURE 8.5 **Extensor Hallucis Longus Muscles**

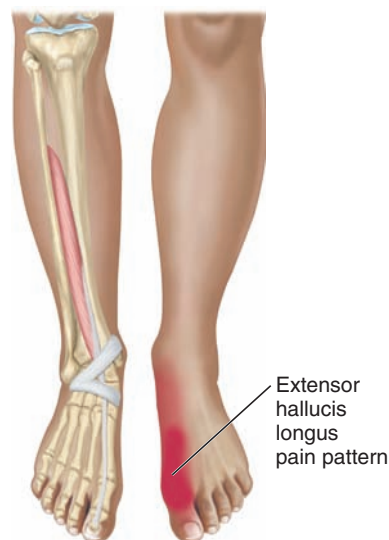


FIGURE 8.6 **Extensor Hallucis Longus Muscle and Referred Pain Pattern**

EXTENSOR DIGITORUM LONGUS, FIGURES 8.7 AND 8.8

ORIGIN	Anterior fibula, lateral condyle of tibia, and interosseous membrane
INSERTION	Bases of distal phalanges of lateral four toes
ACTION	Extends toes; dorsiflexes ankle
MYOTOME	L4, L5, S1

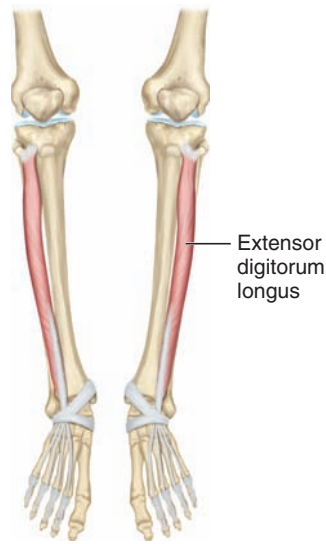


FIGURE 8.7 **Extensor Digitorum Longus Muscles**

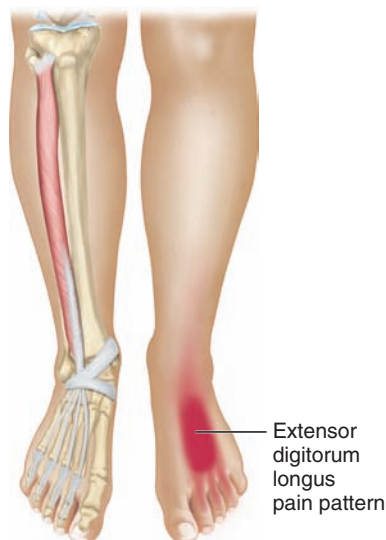


FIGURE 8.8 **Extensor Digitorum Longus Muscle and Referred Pain Pattern**

CLINICAL NOTES: Anterior Lower-Extremity Compartment

With the exception of extensor digitorum brevis, which attaches proximally on the calcaneus, the ALEC runs vertically from attachments just under the knee to various locations on the foot. These muscles are positioned from medial to lateral, starting at the tibia, in the following order: tibialis anterior, extensor hallucis longus, and extensor digitorum longus.

The tibialis anterior is the largest and most powerful muscle of the anterior leg. The tibialis anterior and extensor digitorum longus muscles act equally as a balanced unit to perform dorsiflexion of the ankle. The tibialis anterior is also a primary inverter of the foot and ankle, assisted by the tibialis posterior muscle (posterior leg). Together, the extensor hallucis longus and extensor digitorum longus are responsible for toe extension. As a group, the muscles of the anterior leg are responsible for dorsiflexion of the ankle, inversion of the foot, and extension of the toes.

The tibialis anterior and extensor hallucis longus have similar pain patterns running along the dorsal surfaces of the foot and ankle, all the way to the great toe; however, the tibialis anterior presents with more intense pain in the great toe, whereas the extensor hallucis longus presents with minimal pain in the great toe and more intense pain on the dorsal surface of the first metatarsal bone. Fortunately, the tibialis anterior and extensor hallucis longus muscles lie adjacent to one another. If the intention is to treat one, it is likely that the other will be treated as well.

Both the extensor hallucis longus and the extensor digitorum longus can mimic inflammatory joint pain of the feet and toes that arises from stress on the metatarsal bones and joints.

A hypertonic extensor hallucis longus muscle can cause the great toe to continually buckle, contributing to the formation of arthritis and/or bunions. Similarly, hypertonicity of the extensor digitorum longus and brevis muscles can contribute to hammer toes. Calluses on the plantar surface of the foot, overlying the metatarsal joints, can be another indication of muscular imbalance and improper weight distribution.

Myofascial pain of the leg and foot can be a result of one or more contributing factors: chronic shortening of the ALEC, muscular overload, or skeletal injury. Hypertonicity and muscular overload are preventable and treatable. For example, chronic shortening of the ALEC can be a result of maintaining a dorsiflexed position for a long period of time, such as during a long car ride when the driver holds the foot at an angle on the accelerator pedal. When a person is running on hilly terrain, especially downhill, dorsiflexion of the ankles keeps the body weight toward the back of the heels to control speed; this often overloads the ALEC muscles.

Skeletal injuries should be treated by a medical professional. Foot disorders should be evaluated and treated by a podiatrist.

ROUTINE: Anterior Lower-Extremity Compartment

Position of client: supine.

1. Using the fingertips, treat the ALEC with slow, deep effleurage, separating the muscular divisions. (See Figure 8.9.)
2. Using fingertips, treat the intermuscular septum and muscles of the dorsal surface of the foot with slow, deep effleurage and compression from the metatarsal-phalangeal joints to the ankle. (See Figure 8.10.)

Stabilize the foot, and slightly flex the toes.

3. Flex and stretch the tendon lines of each toe. Treat the individual tendon lines with static compression and friction in 1-inch segments from toe to ankle. (See Figure 8.11.)
4. Isolate and traction each digit independently. Repeat tendon work over the metatarsal-phalangeal joints while performing range of motion on the joints.
5. Using the fingertips, administer slow, deep effleurage and compressions in 1-inch segments in a superior direction from the ankle to the knee, treating the intermuscular septum and the muscle bellies between the tibia and the fibula. (See Figure 8.12.)

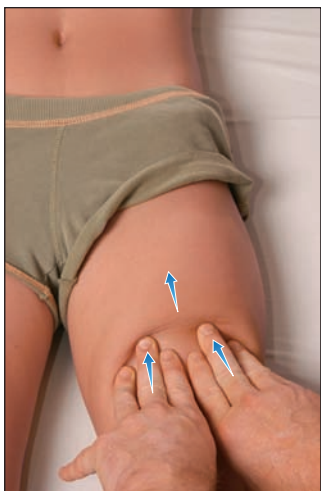


FIGURE 8.9



FIGURE 8.10



FIGURE 8.11



FIGURE 8.12

6. Using the thumbs, treat the muscle bellies of the anterior compartment with slow, deep compressions and friction in 1-inch segments from the ankle to the knee. (See Figure 8.13.)

Use focused intent when using the elbow in this small area. Stabilize the elbow with the web of the hand to ensure a smooth transition when compressing, frictioning, and gliding.

7. Using the elbow, treat the anterior compartment with static compression moving in 1-inch segments. After compression, transition your work into a slow, gliding effleurage tracing three lines. (See Figure 8.14.)
8. Using contoured palms, effleurage the entire leg.



FIGURE 8.13

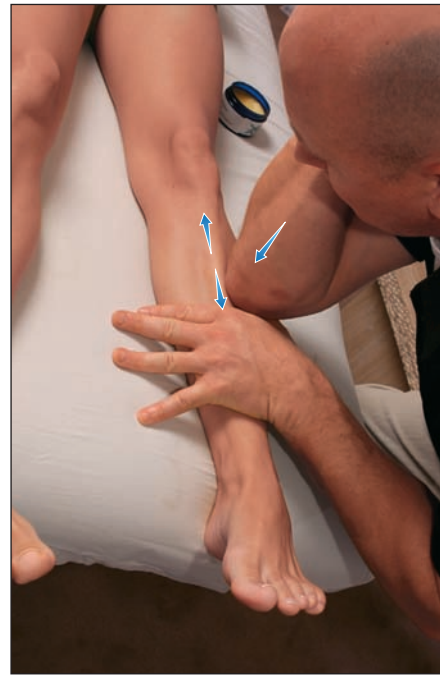


FIGURE 8.14

PERONEALS

PERONEUS LONGUS, FIGURES 8.15 AND 8.16

ORIGIN	Lateral proximal two-thirds of shaft of fibula
INSERTION	Base of 1st metatarsal and 1st cuneiform
ACTION	Eversion of foot; assists plantar flexion of ankle
MYOTOME	L4, L5, S1

PERONEUS BREVIS, FIGURES 8.15 AND 8.16

ORIGIN Lateral distal two-thirds of shaft of fibula

INSERTION Base of 5th metatarsal

ACTION Eversion of foot; assists plantar flexion of ankle

MYOTOME L4, L5, S1

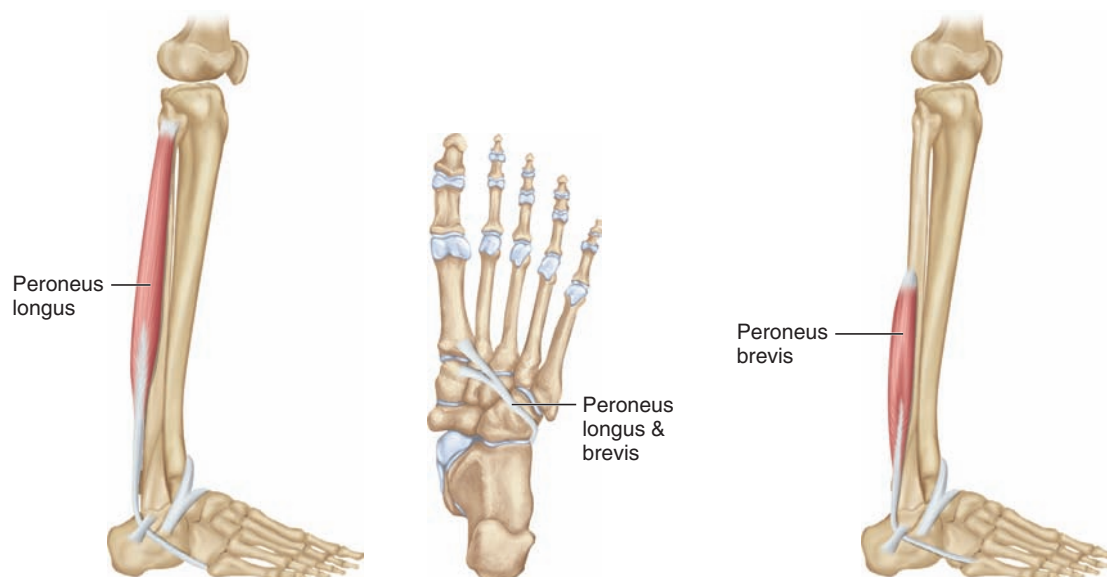


FIGURE 8.15 **Peroneus Longus and Peroneus Brevis Muscles**



FIGURE 8.16 **Peroneus Longus and Peroneus Brevis Muscles and Referred Pain Pattern**

PERONEUS TERTIUS, FIGURES 8.17 AND 8.18

ORIGIN	Anterior distal shaft of fibula
INSERTION	Base of 5th metatarsal
ACTION	Eversion of foot; assists dorsiflexion of ankle
MYOTOME	L5, S1



FIGURE 8.17 **Peroneus Tertius Muscle**



FIGURE 8.18 **Peroneus Tertius Muscle and Referred Pain Pattern**

CLINICAL NOTES: Peroneals

The peroneals consist of the peroneus longus, peroneus brevis, and peroneus tertius muscles. The large bony landmark, the lateral malleolus, serves as a leverage point for the peroneals to pull the lateral side of the foot upward and produce eversion.

The peroneus tertius runs anterior to the lateral malleolus; it is anchored by the superior extensor retinaculum, and it assists (the tibialis anterior and extensor digitorum longus) in dorsiflexion of the ankle. The peroneus tertius and brevis share a common insertion at the base of the 5th metatarsal; however, the superficial peroneus longus and deeper peroneus brevis run posterior to the lateral malleolus. Anchored by the peroneal retinaculum, these muscles assist the gastrocnemius and soleus in plantar flexion of the ankle.

The peroneus longus travels down the lateral leg (fibula) and comes in from the lateral side underneath the foot, toward the arch, attaching on the 1st metatarsal and 1st cuneiform.

The tibialis anterior travels down the anterior leg (tibia) and comes in from the medial side, toward the arch of the foot and attaches to the opposite side of the 1st metatarsal and middle cuneiform. Together, the peroneus longus and tibialis anterior coming in from opposite directions form a sling for the foot and perform opposite actions: eversion and inversion.

Ankle stability and a balanced gait are controlled by the everter-inverter muscle groups. The inverters are the tibialis anterior and tibialis posterior; the everters are the peroneals. All of these muscles should be treated when painful and weak ankles are present. When these two groups are imbalanced, peroneal inflammation, weak ankles, stress fractures, and shin splints can result.

Weak everters and/or hypertonic inverters put a disproportionate amount of weight on the lateral sole of the foot. The lateral ridge of the foot becomes the contact site during ambulation, increasing the stress on the base of the 5th metatarsal bone and further weakening the peroneal muscles.

The tibial-talar joint affects dorsiflexion and plantar flexion movements of the foot at the ankle; the subtalar joint affects inversion and eversion movements of the foot at the ankle.

Long-term muscular imbalance of these joints can lead to improper foot alignment, changes in arches, and ligament laxity. Chronic sprained ankles directly affect walking, running, and twisting movements, thereby hindering optimum performance in many athletic activities.

ROUTINE: Peroneals

Position of client: side-lying, with the upper leg extended at the hip and bolstered with a pillow. The ankle and foot should hang freely off the pillow. The client's lower leg should be flexed at the hip and knee (jackknifed) to provide stability. (See Figure 8.19.)

1. Using the fingertips, treat the peroneals and lateral thigh muscles with slow, deep effleurage from the lateral malleolus to the greater trochanter, separating the muscular divisions. (See Figure 8.20.)

Continue with slow, deep effleurage in two separate directions: first, moving toward the ASIS and then toward the PSIS landmarks of the pelvis.

2. Using the fingertips or thumbs, treat the peroneus longus tendon crossing the plantar surface of the foot with static compression and friction. (See Figure 8.21.)
3. Using the fingertips or thumbs, glide and compress from the base of the 5th metatarsal to the lateral malleolus, treating the peroneal tendons. (See Figure 8.22.)
4. Continue gliding and compressions in two separate divisions: anterior and posterior to the lateral malleolus.
5. Using contoured hands (thumb leading fingers), glide from the lateral malleolus to the lateral knee. Treat the peroneals with static compression moving in 1-inch segments. (See Figure 8.23.)
6. Use one hand to keep the foot inverted, slightly stretching the peroneals, while the contoured palm of the other hand treats the lateral compartment with slow, deep effleurage and static compression. Treat in 1-inch segments utilizing the edge technique while compressing and stretching for maintaining client comfort. (See Figure 8.24.)



FIGURE 8.19



FIGURE 8.20



FIGURE 8.21



FIGURE 8.22

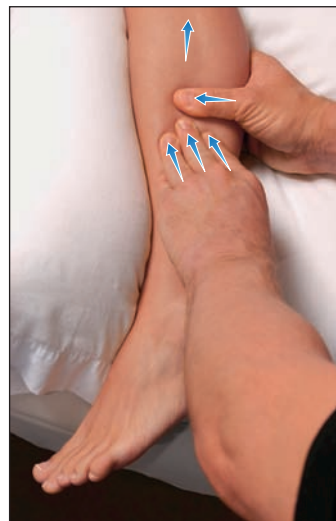


FIGURE 8.23

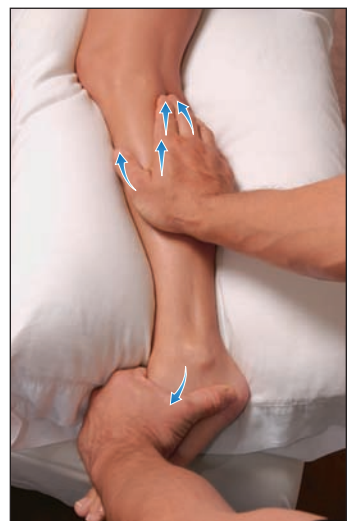
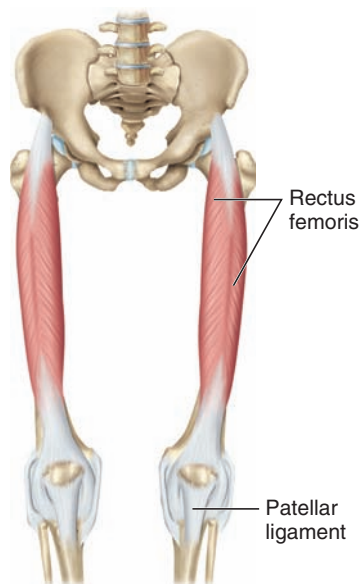
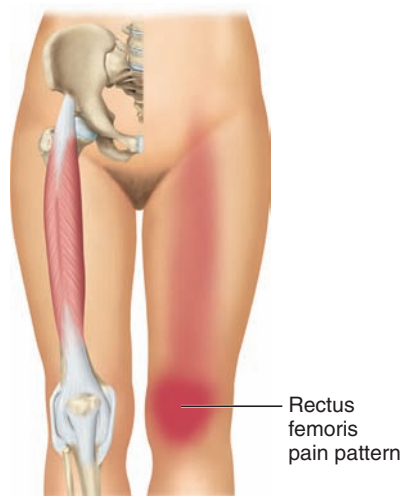


FIGURE 8.24

QUADRICEPS FEMORIS**RECTUS FEMORIS,** FIGURES 8.25 AND 8.26

ORIGIN	AIIS
INSERTION	Patella and tuberosity of tibia, via patellar ligament
ACTION	Extends knee; flexes hip
MYOTOME	L2–L4

FIGURE 8.25 **Rectus Femoris Muscles**FIGURE 8.26 **Rectus Femoris Muscle and Referred Pain Pattern**

VASTUS MEDIALIS, FIGURES 8.27 AND 8.28

ORIGIN	Posterior femur
INSERTION	Patella and tuberosity of tibia via the patellar ligament
ACTION	Extends knee
MYOTOME	L2–L4

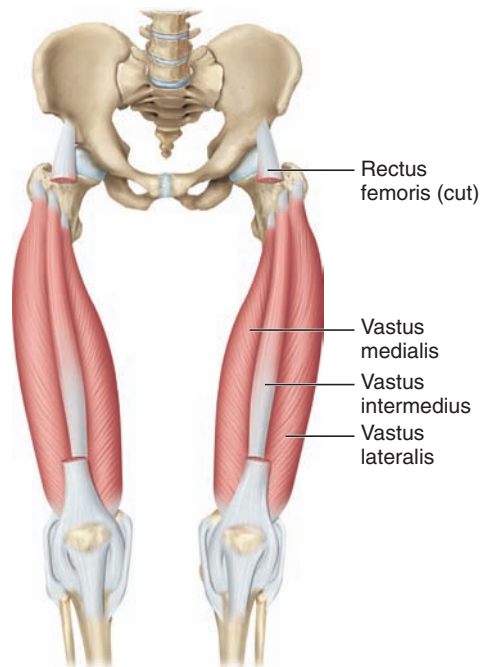


FIGURE 8.27 **Vastus Medialis, Vastus Intermedius, and Vastus Lateralis Muscles**

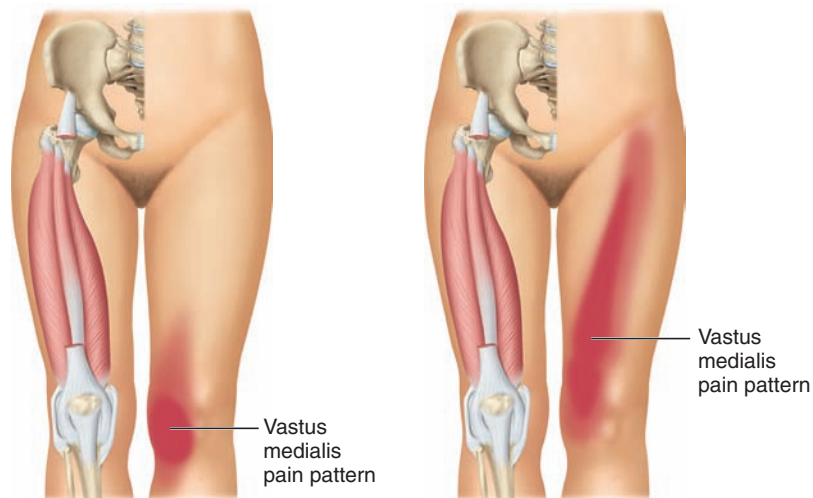


FIGURE 8.28 **Vastus Medialis Muscle and Referred Pain Patterns**

VASTUS INTERMEDIUS, FIGURES 8.27 AND 8.29

ORIGIN	Anterior femur
INSERTION	Patella and tuberosity of tibia via patellar ligament
ACTION	Extends knee
MYOTOME	L2–L4

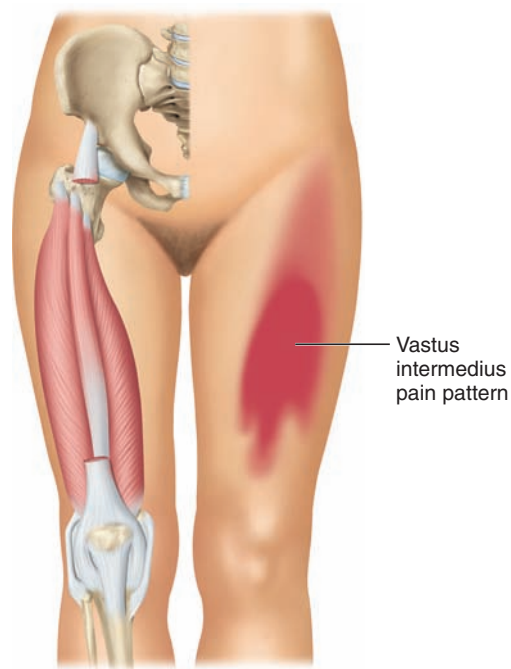


FIGURE 8.29 **Vastus Intermedius Muscle and Referred Pain Pattern**

VASTUS LATERALIS, FIGURES 8.27, 8.30, AND 8.31

ORIGIN	Posterior femur
INSERTION	Patella and tuberosity of tibia via the patellar ligament
ACTION	Extends knee
MYOTOME	L2–L4

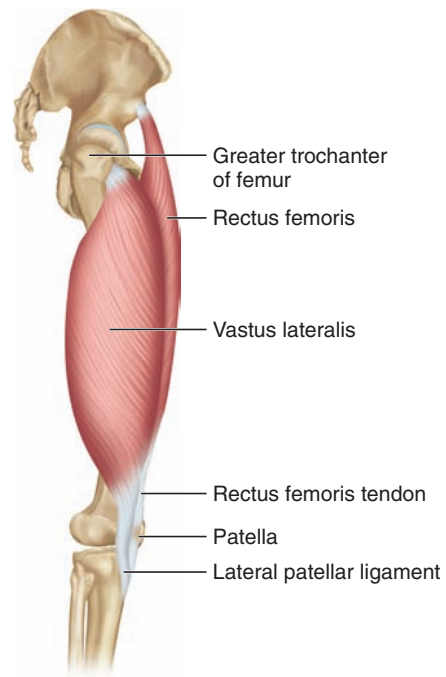


FIGURE 8.30 **Vastus Lateralis Muscle**

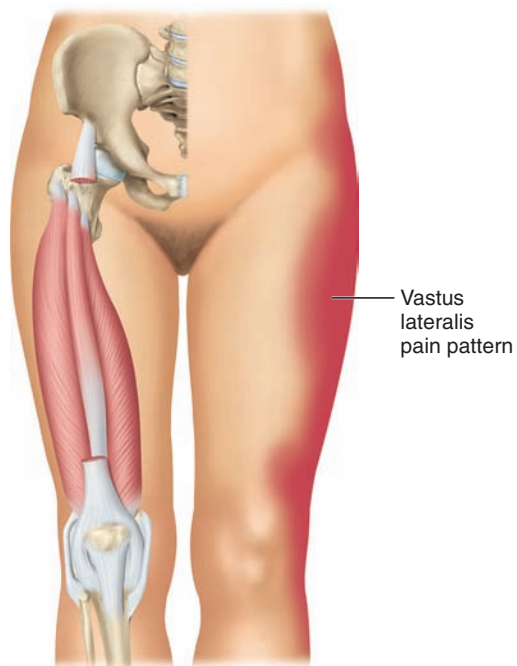


FIGURE 8.31 **Vastus Lateralis Muscle and Referred Pain Pattern**

SARTORIUS, FIGURES 8.32 AND 8.33

ORIGIN	ASIS
INSERTION	Pes anserinus—medial proximal tibial shaft
ACTION	Flexes, abducts, and laterally rotates thigh at hip; medially rotates leg during knee flexion
MYOTOME	L2, L3

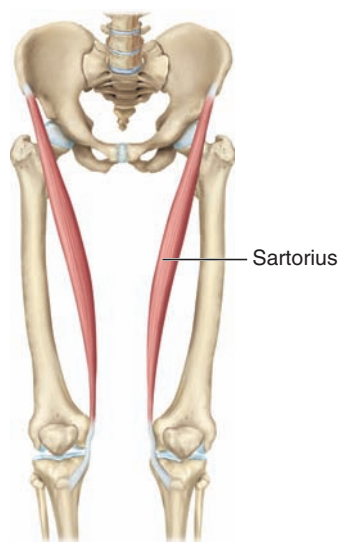


FIGURE 8.32 **Sartorius Muscles**

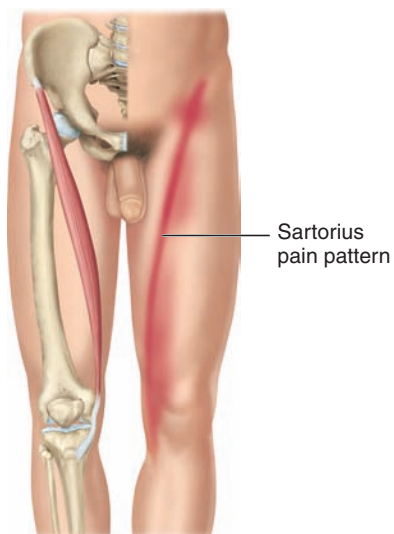


FIGURE 8.33 **Sartorius Muscle and Referred Pain Pattern**

CLINICAL NOTES: Quadriceps Femoris

The four quadriceps femoris muscles are rectus femoris, vastus medialis, vastus intermedius, and vastus lateralis. The quadriceps femoris muscles merge to form a strong tendon which collectively attaches the anterior thigh muscles to the patella. Below, the patellar ligament anchors the patella to the tibial tuberosity. From above, the rectus femoris attaches to the anterior inferior iliac spine (AIIS) and crosses both the knee joint and hip joint. Deep to the rectus femoris lies the vastus intermedius, which lies between the vastus medialis and the vastus lateralis. The vastus intermedius attaches on the anterior and lateral shaft of the femur, whereas the vastus medialis and vastus lateralis attach to the posterior shaft of the femur along their originating sides. The primary function of the quadriceps is extension of the leg at the knee; the two-joint rectus femoris muscle also assists the iliopsoas and pectineus muscles in hip flexion. The quadriceps femoris muscle group is the largest muscle group in mass (the gluteal group is the second largest).

The sartorius muscle is the most superficial muscle on the anterior thigh, but it is not considered one of the quadriceps femoris muscles. The sartorius, nicknamed the “tailor muscle,” is the longest skeletal muscle in the body and forms the lateral border of the femoral triangle; the gracilis forms the medial border and the inguinal ligament forms the superior border of the femoral triangle. Within the borders of the femoral triangle lies the anterior portion of the adductor muscles. The sartorius originates on the ASIS and shares a common insertion site with the gracilis and semitendinosus muscles on the medial proximal shaft of the tibia (pes anserinus). Since the sartorius crosses both hip and knee joints, it has an action on both. Its actions are not straightforward, however; due to the diagonal course of the muscle crossing the thigh, the muscle contributes to flexion, abduction, and lateral rotation of the leg at the hip joint. At the knee joint the muscle contributes to flexion and medial rotation of the leg.

The primary symptoms of myofascial trigger points in the quadriceps femoris muscles are weakness and relatively localized soft-tissue pain. When pain is persistent on the anterior medial thigh and knee, arising from vastus medialis, it is common for the knee to buckle or suddenly “give out.” Lateral thigh pain arising from vastus lateralis is usually manifested as an electrical shooting pain that explodes up and down the thigh.

Deep, local midthigh pain may be attributed to vastus intermedius, but midthigh pain with secondary referral on the lateral leg from the knee to the hip is most characteristic of vastus lateralis; however, this pain pattern can easily be mistaken for a hypertonic tensor fasciae latae, as it refers pain to the greater trochanter with referral pain spilling down the lateral thigh. Iliotibial band syndromes caused by a hypertonic gluteus maximus and tensor fasciae latae, and trigger points in the lateral collateral ligament, also have pain referrals that mimic the vastus lateralis muscle.

The quadriceps femoris muscles attach on the patella and therefore play an important role in musculoskeletal knee pathology. The quadriceps group and hamstrings counter each other during weight-bearing ambulation. When there is muscular imbalance between the two, it may cause intrajoint pressure and inflammation, which can result in a degenerative meniscus and arthritis of the knee joint. Vastus medialis and vastus lateralis counterstabilize the patella on abnormal angulation of the knee joint resulting from muscular overload and/or body asymmetries. If one of these

muscles is hypertonic, this can cause the patella to be locked in an abnormal position. Torn cartilage around the knee is often the result of chronic improper patellar tracking and/or tibial torsioning.

The quadriceps femoris dysfunction can be exacerbated by muscular overload, mechanical joint involvement (tibial torsioning), muscular and/or ligament injury, improper patellar tracking, chronic joint inflammation, and postsurgical intervention.

ROUTINE: Quadriceps Femoris

Position of client: supine, with the legs supported and hanging off the end of the table. Place a pillow under the client's head to prevent arching of the lower back. (See Figure 8.34.)

1. Using the fingertips, treat the ALEC with slow, deep effleurage and compressions into the muscle bellies. (See Figure 8.35.)
2. To treat the knee, first check the movement of the patella (lateral, medial, superior, and inferior). Stabilize the patella. Using the index finger, friction the tendinous attachments around the border of the patella. (See Figure 8.36.)
3. Using contoured hands (thumbs leading fingers), treat the quadriceps femoris group with slow, deep effleurage tracing three lines (medial, median, and lateral) from the patella, moving upward toward the ASIS. (See Figure 8.37.)
4. Using the fingertips, apply compressions in 1-inch segments utilizing the edge-technique. Holding static compressions while maintaining client comfort will allow for deeper access into the deeper layers of muscle. Continue with slow, deep effleurage, tracing three lines (medial, median, and lateral). (See Figure 8.38.)
5. Locate the rectus femoris, and move it medially and/or laterally. Using the fingertips, compress into the underlying vastus intermedius muscle in 1-inch segments. Then continue with slow, deep effleurage from the patella, moving upward toward the ASIS. (See Figure 8.39.)

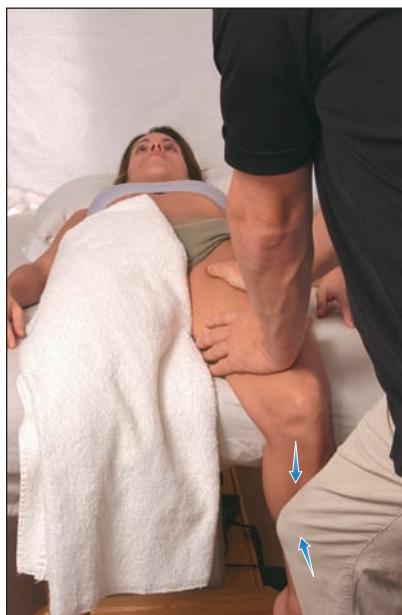


FIGURE 8.34



FIGURE 8.35



FIGURE 8.36



FIGURE 8.37

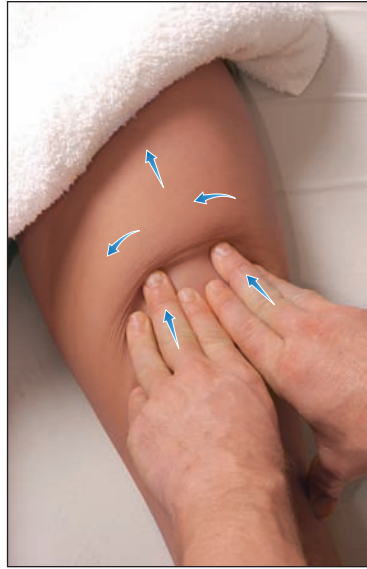


FIGURE 8.38

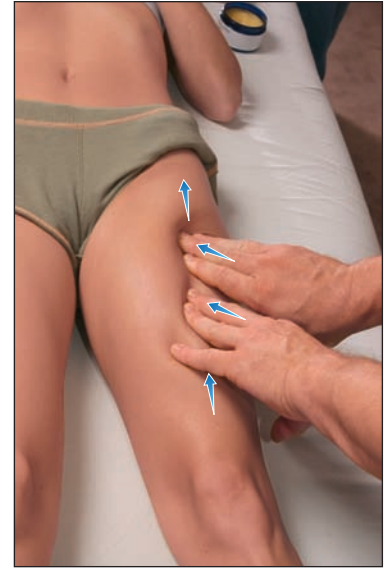


FIGURE 8.39

6. Using the fingertips, treat the upper and deeper fibers of the rectus femoris (toward its attachment on the AIIS) with slow, deep compressions and friction. Then continue with treatment along the sartorius and laterally toward and on the TFL. (See Figure 8.40.)

Flex the client's leg; then support it with your knee to treat the tendons inserting on the pes anserinus.

7. Locate the pes anserinus on the medial condyle of the tibia. Using the fingertips, isolate and treat the tendons of the gracilis, sartorius, and semitendinosus with slow, isolating compressions and light friction. (See Figure 8.41.)
8. Using the fingertips, glide superiorly from the knee to the ASIS. Reposition the leg straight, and glide superiorly from the knee to the ASIS, treating the sartorius muscle. Hold and compress areas that are hypersensitive. (See Figure 8.42.)
9. Treat the thigh with deep, slow effleurage, tracing three lines (medial, median, and lateral).



FIGURE 8.40



FIGURE 8.41

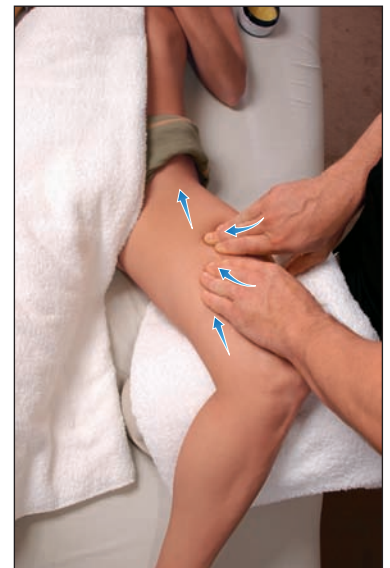


FIGURE 8.42

TENSOR FASCIAE LATAE, FIGURES 8.43 AND 8.44

ORIGIN Iliac crest—ASIS to PSIS

INSERTION Lateral condyle of tibia via iliotibial tract

ACTION Flexes, abducts, and medially rotates thigh

MYOTOME L4, L5, S1

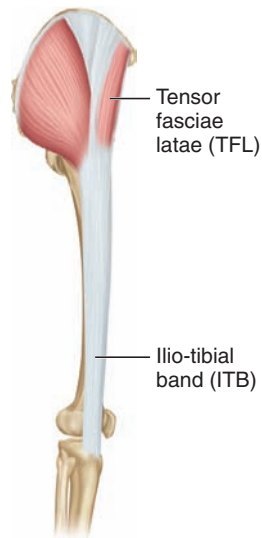


FIGURE 8.43 **Tensor Fasciae Latae Muscle**

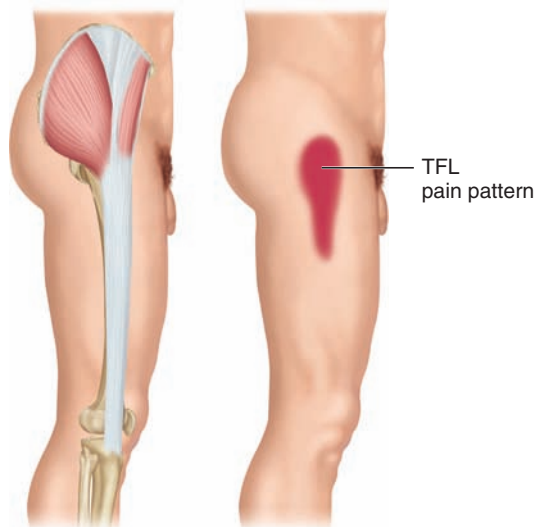


FIGURE 8.44 **Tensor Fasciae Latae Muscle and Referred Pain Pattern**

CLINICAL NOTES: Tensor Fasciae Latae

The tensor fasciae latae (TFL) muscle merges with the longitudinal fascia of the gluteus maximus to form the iliotibial band (ITB). This tendinous band stretches to the lateral condyle of the tibia, just below the knee. Its strong, interweaving fibers are isometric in nature, as they prevent the knee from collapsing or buckling laterally.

The TFL is perpetually tense, as it is more responsible for controlling and defining movement than for producing it. Proximally, the TFL acts as a shock absorber as it stabilizes the hip against lateral pelvic weight shift.

The TFL functions as a synergist to the iliopsoas, rectus femoris, sartorius, and pectineus muscles, which perform hip flexion. Additionally, the TFL assists the gluteus medius and gluteus minimus muscles in medial rotation and abduction of the thigh.

Sleeping on the side in the fetal position can increase the tension of the TFL. It is beneficial for a person in that position to place a pillow between the legs. Sitting for long periods with the hips acutely flexed will also shorten the fibers of the TFL. Stretching the muscles may help alleviate hypertonicity resulting from a prolonged contracted position.

Continuous jumping during sports such as tennis, basketball, racquetball, and long-distance running can cause muscular overload and may perpetuate myofascial trigger points in the TFL muscle. Myofascial pain associated with TFL trigger points is localized within the hip and slightly below it.

ROUTINE: Tensor Fasciae Latae

Position of client: side-lying, with the upper leg extended at the hip and bolstered and the ankle and foot hanging off the therapy pillow. The client's lower leg should be flexed at the hip and knee (jackknifed) to provide stability. (See Figure 8.45.)

1. Using both hands, pick up and compress (as much of the tissues as possible) the vastus lateralis and ITB. Treat with compression and friction, moving in 1-inch segments. (See Figure 8.46.)



FIGURE 8.45

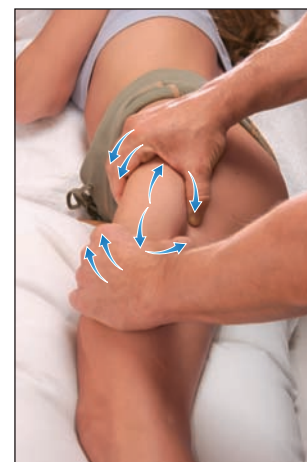


FIGURE 8.46

Continue with compression and friction in two separate divisions, moving toward the ASIS and the PSIS.

2. Treat the muscular divisions and intermuscular septum of the vastus lateralis, ITB, and TFL. Using the fingertips of one hand, glide from inferior to superior. Simultaneously use the other hand to treat the opposite border with gliding compression. (See Figure 8.47.)
3. Using contoured hands, stretch the myofascia with both hands moving horizontally (following the Langer lines) around the leg while applying downward pressure toward the table. (See Figure 8.48.)
4. Treat the vastus lateralis and TFL with static compression and friction.
5. Treat the upper leg with slow, deep petrissage.
6. Using contoured palms, effleurage the entire leg.

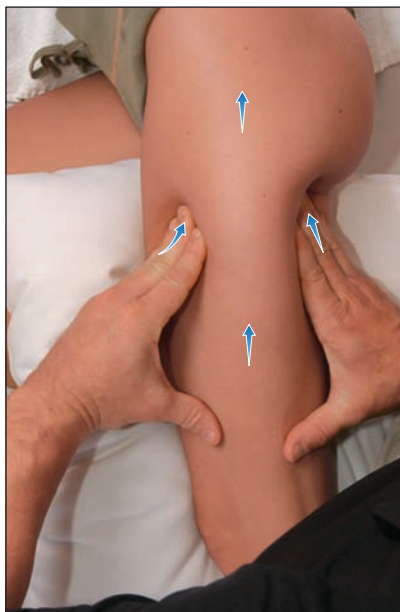


FIGURE 8.47



FIGURE 8.48

PECTINEUS, FIGURES 8.49 AND 8.50

ORIGIN	Anterior pubis
INSERTION	Upper medial and posterior shaft of femur
ACTION	Flexes, adducts, and medially rotates thigh at hip
MYOTOME	L2–L4

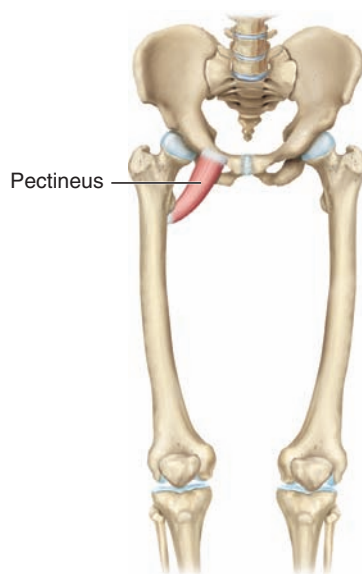


FIGURE 8.49 **Pectineus Muscle**

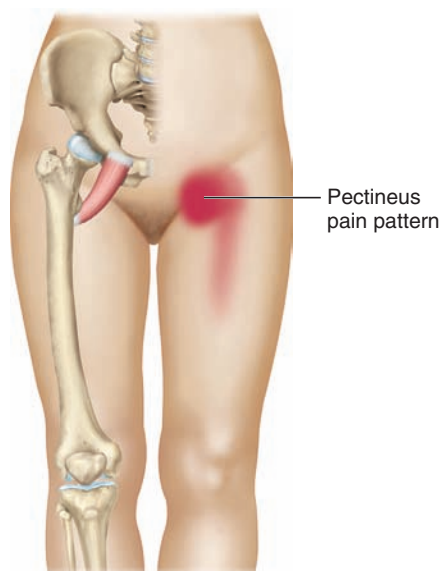


FIGURE 8.50 **Pectineus Muscle and Referred Pain Pattern**

CLINICAL NOTES: Pectineus

The pectineus muscle lies in the groin, approximately halfway between the midline (pubis symphysis) and the hip. The direction of muscle fibers runs 45 degrees from its origin on the pubic bone to the insertion site located behind and below the lesser trochanter.

The pectineus, with the adductors and iliopsoas muscles, provides adduction and flexion movements of the thigh at the hip, and these muscles have similar pain patterns within the anterior and medial thigh. The biggest difference between the pectineus pain pattern and that of the adductor muscles and the iliopsoas muscle is that the pectineus pattern is a local, deep, and persistent pain within the groin.

If examination of the pectineus muscle reveals no underlying muscular restriction and tenderness and the client has no history of muscular injury from strain and/or overload, refer the client to a primary physician for a medical evaluation.

ROUTINE: Pectineus

Penetration of the pectineus is done slowly and precisely. The pectineus muscle is palpated in the upper corner of the femoral triangle. When working in this area, be aware of the femoral arterial pulse. If at any time you are on the pulse, reposition your hands medially. Do not stimulate this or other neurovascular structures of the body.

Position of client: supine, with the leg flexed outward at a 45-degree angle, supported by your knee.

1. Using the fingertips, treat the anterior lower-extremity compartment with slow, deep effleurage, isolating and separating the muscular divisions of the upper and medial thigh. (See Figure 8.51.)
2. Locate the sartorius, and use it as a landmark. Glide superiorly on the sartorius muscle to the inguinal crease. Fall off medially approximately 2 inches below the inguinal crease. This is where the pectineus muscle is located. Using the fingertips, treat the pectineus with slow, deep compressions in 1-inch segments. Utilize the edge-technique for maintaining client comfort. (See Figures 8.52 and 8.53.)
3. Using the fingertips or a contoured hand, treat with compression while gliding as far under the inguinal ligament as possible. Once the pectineus is isolated, apply broad compressions in 1-inch segments. (See Figure 8.54.)

Always be aware of your client's comfort level. Remember: No pain means more gain.



FIGURE 8.51



FIGURE 8.52



FIGURE 8.53



FIGURE 8.54

ADDUCTOR GROUP**ADDUCTOR MAGNUS,** FIGURES 8.55 AND 8.56

ORIGIN Anterior pubis to ischial tuberosity

INSERTION Linea aspera; adductor tubercle of femur

ACTION Adducts hip; assists in lateral rotation, flexion (anterior fibers), and extension (posterior fibers) of hip

MYOTOME L3, L4

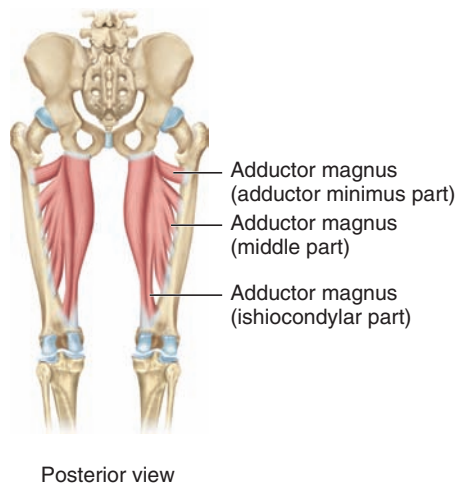


FIGURE 8.55 **Adductor Magnus Muscles (posterior view)**

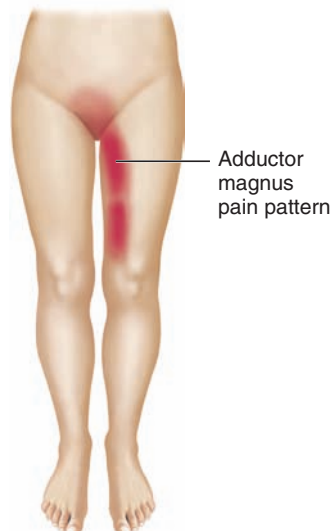


FIGURE 8.56 **Adductor Magnus Referred Pain Pattern**

GRACILIS, FIGURES 8.57 AND 8.58

ORIGIN Anterior pubis

INSERTION Pes anserinus—medial proximal tibial shaft

ACTION Flexes, adducts, and medially rotates thigh at hip; flexes knee

MYOTOME L3, L4

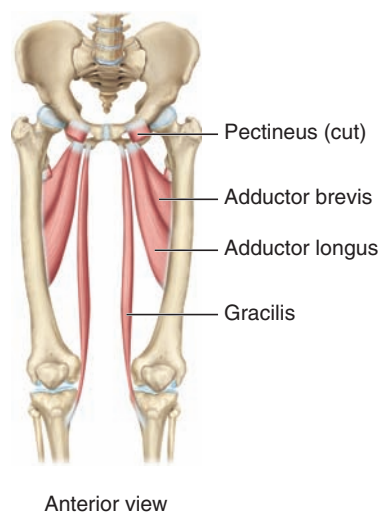


FIGURE 8.57 **Adductor Group Muscles: Gracilis, Adductor Longus, and Adductor Brevis (anterior view)**

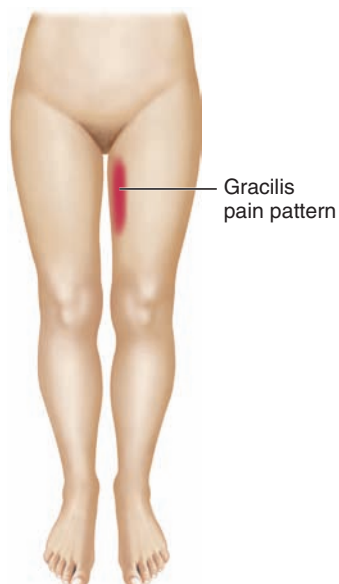


FIGURE 8.58 **Gracilis Referred Pain Pattern**

ADDUCTOR LONGUS, FIGURES 8.57 AND 8.59

ORIGIN	Anterior pubis
INSERTION	Middle shaft of posterior femur
ACTION	Adducts thigh at hip; laterally rotates thigh
MYOTOME	L3, L4

ADDUCTOR BREVIS, FIGURES 8.57 AND 8.59

ORIGIN	Anterior pubis
INSERTION	Proximal shaft of posterior femur
ACTION	Adducts thigh at hip; assists in lateral rotation of thigh
MYOTOME	L3, L4

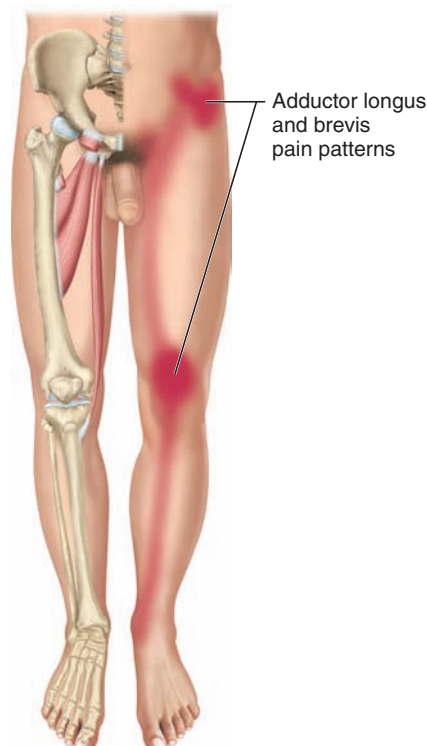


FIGURE 8.59 **Adductor Longus and Adductor Brevis Referred Pain Patterns**

CLINICAL NOTES: Adductor Group

The adductor muscle group originates on the anterior pubis, with the attachment of the adductor magnus extending to the ischial tuberosity. Each muscle in this group attaches to the posterior femur, with the exception of the gracilis. The gracilis crosses the hip and knee joints to share a common attachment site with the sartorius and semitendinosus on the medial proximal tibial shaft, also known as *pes anserinus*. The gracilis is the most superficial and medial muscle on the thigh.

The adductor group is the group of muscles that perform adduction of the leg at the hip. Similar to the hamstring group, each muscle in the adductor group also rotates the leg at the hip. The pectineus and gracilis assist in medial rotation of the leg, while the adductor longus, adductor brevis, and adductor magnus perform lateral rotation of the leg. Additionally, the adductor magnus assists in hip flexion and hip extension; therefore, it is continuously active during ambulation. The gracilis, a two-joint muscle, also slightly assists in hip and knee flexion from a straight-leg position. As a functional unit, the adductors control lateral weight shift when standing and help to stabilize the hip and knee during ambulation.

Medial thigh and knee pain and limited range of motion during abduction of the hip are the primary symptoms of myofascial trigger points of the adductor muscles. Pain along the inguinal ligament and deep inside the groin is also commonly associated with injury and chronic hypercontraction of the adductor muscles.

The acuteness of groin pain can be brought on by repetitive straining exercises, especially when weight-bearing activities involve flexion and adduction movements. Runners, weight lifters, football players, and golfers are some of the athletes most susceptible to groin injuries from repetition and chronic overload. Other strenuous weight-bearing activities such as tennis, skiing, dancing, long hikes on uneven terrain, or any activity involving large strides or twisting of the hips can cause groin injuries as well. Sustained contraction of the adductors during horseback riding can also perpetuate myofascial trigger points.

Thigh pain can stem from various other musculoskeletal pathologies, including stenosis and osteoarthritis of the back and hip joints. Vertebral distortions can cause lumbosacral nerve root compression, which can lead to numbness and tingling of the thigh. This kind of thigh pain can also be an indicator of nerve entrapment. There are three main nerves that could be affected, including the femoral nerve in the anterior thigh, the obturator nerve in the medial thigh, and the sciatic nerve in the posterior thigh. If the frequency and intensity of pain persist, the client should be referred to a primary care physician for a full medical and diagnostic evaluation to determine the underlying cause.

The medial thigh, where the large adductor muscle group is located, is a vulnerable area. It is important to do everything possible to make the client feel comfortable. Before treating this area, educate the client about the location of the adductor muscles and their attachments. Advise the client to wear undergarments or running shorts during the massage to ensure personal comfort. As always,

proper draping is essential, especially when you are working with someone of the opposite sex. In a sensitive area such as this, it is best to work slowly, using a broad stroke. Cross-fiber friction can be used to identify muscle fibers and tendons, but slow, broad compression and slow gliding will be less intrusive for the client.

A home stretching program will maximize the benefits of the therapy session. Daily stretching of the adductors, abductors, hamstrings, and quadriceps will help restore proper functioning of the lower-extremity musculature.

ROUTINE: Adductor Group

This is a sensitive area to treat so communicating with the client is vital to ensure her comfort level. Reassure the client by informing her that she will be adequately covered and not exposed at any time during the treatment. The adductor treatment is simple, but it is extremely important to spend enough time to ensure a complete myofascial release.

Position of client: side-lying, with the upper leg flexed at the hip 90 degrees and bolstered. This should allow adequate clearance to treat the medial aspect of the medial thigh. (See Figure 8.60.)

1. Using the fingertips, treat the adductors with slow, deep compressions, separating the muscular divisions. Continue with slow, deep compressions in two separate divisions anterior to the pubic bone and posterior to the ischial tuberosity. (See Figure 8.61.)
2. Using the fingertips, treat anterior to the gracilis with a slow, deep compression glide from the knee toward the pubic bone. Now move the fingers posterior to the gracilis. Continue the compression glide from the knee toward the ischial tuberosity. Hold static compression to hypersensitive areas. (See Figure 8.62.)



FIGURE 8.60



FIGURE 8.61



FIGURE 8.62

Proceed deeper with the client's comfort level (as determined via verbal communication) until a substantial release and softening of the muscles has been achieved.

3. Isolate the ischial tuberosity. Fall off the ischial tuberosity and treat the adductor magnus with slow, deep compressions and friction, moving in 1-inch segments. (See Figure 8.63.)
4. Using the knee, treat the adductor muscle group; this allows for a broader compression and a deeper penetration into layers of muscle that cannot be reached using the hands and fingertips. (See Figure 8.64.)

Have the client move to a supine position with the leg flexed outward, supported by your knee.

5. Using the gracilis as a landmark, treat the adductors with slow, deep compressions. (See Figure 8.65.)

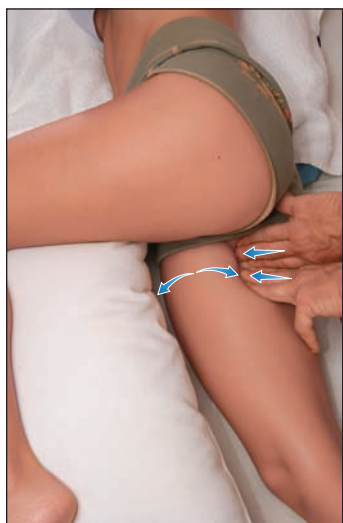


FIGURE 8.63

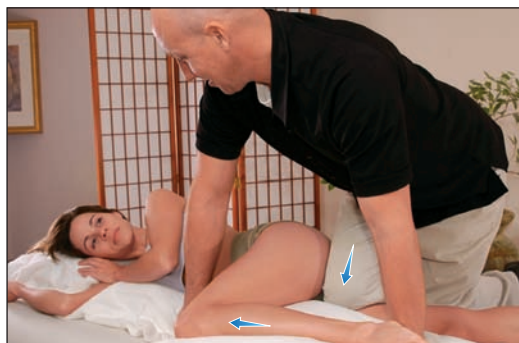


FIGURE 8.64

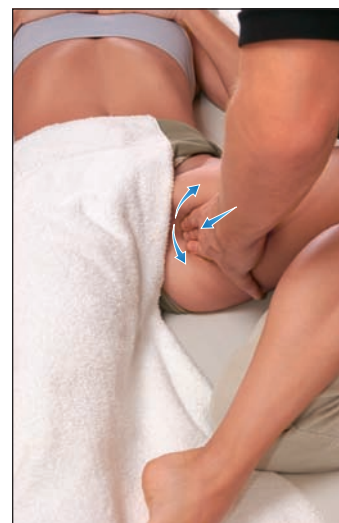


FIGURE 8.65

ILIOPSOAS

PSOAS MAJOR, FIGURES 8.66 AND 8.67

ORIGIN Vertebral bodies, intervertebral disks, anterior transverse processes of T12–L5

INSERTION Lesser trochanter of femur

ACTION Flexes hip; flexes lumbar vertebrae; controls rate of extension of lumbar vertebrae; proximates lumbar vertebrae toward femur

MYOTOME L1–L4

ILIACUS, FIGURES 8.66 AND 8.67

ORIGIN Inner surface of iliac fossa

INSERTION Lesser trochanter of femur

ACTION Flexes hip

MYOTOME L2, L3

Note: See Chapter 7, 175–181 for the clinical notes and routines for the iliopsoas group.

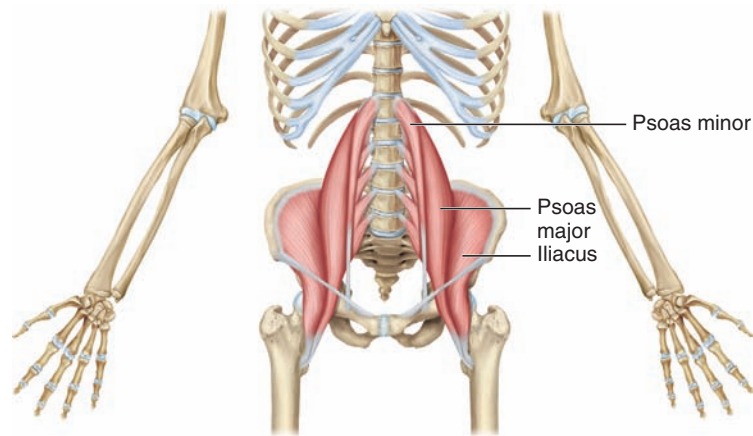


FIGURE 8.66 **Iliopsoas Muscles: Psoas Major, Psoas Minor, and Iliacus**

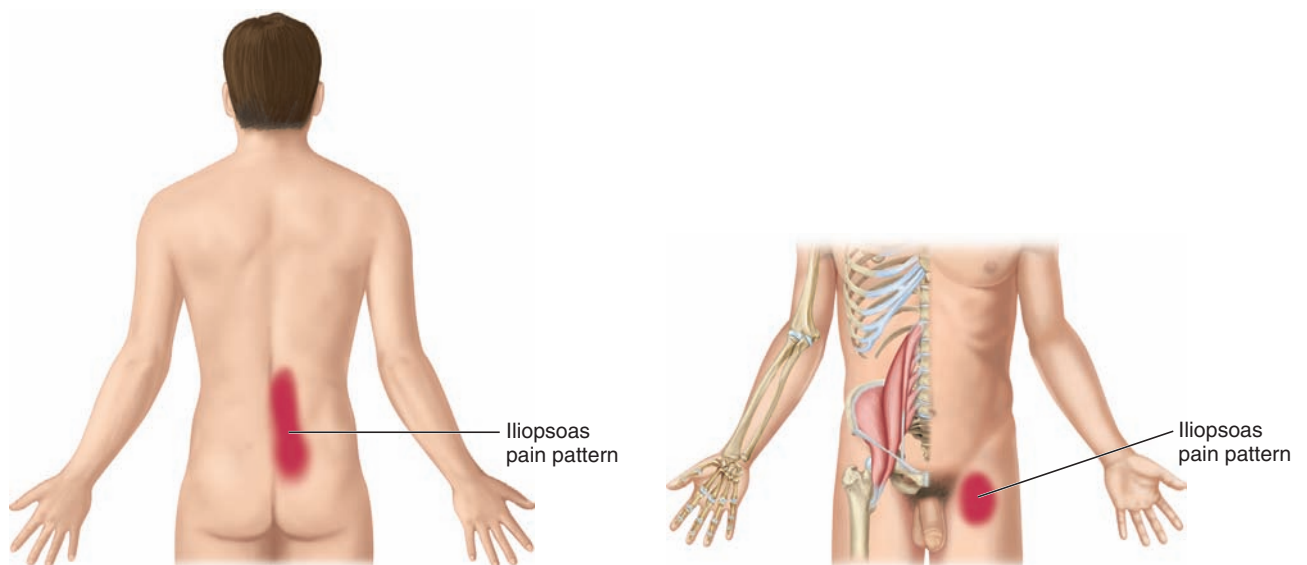


FIGURE 8.67 **Iliopsoas Muscles and Referred Pain Patterns**

STRETCHING

While lying on the stomach with the knee flexed, the client grasps the foot and toes and pulls toward the buttock.



FIGURE 8.68 ALEC stretch (prone)

While standing with the knee flexed, the client grasps the foot and toes and pulls up toward the buttock.



FIGURE 8.69 ALEC stretch, standing, foot and extensor

With one foot planted on the ground and the other leg lying on the table, and with the knee flexed, the client grasps the top of the foot and pulls the heel toward the buttock.

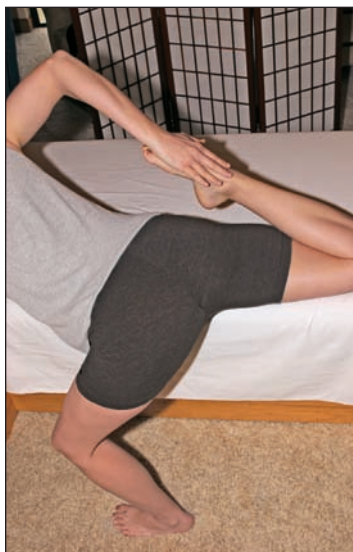


FIGURE 8.70 Complete anterior lower-extremity stretch

While lying on the back and with the knee flexed, the client rests the foot on your thigh; with one hand cupping the heel, use your other hand to grasp the toes and flex downward.



FIGURE 8.71 Assisted foot and extensor stretch

While the client is lying on the stomach, anchor the pelvis with a seat belt (place a cushioned towel as a barrier between the seat belt and the body for added client comfort). Place your knee underneath the client's thigh. Your lower hand supports the knee, keeping it aligned, while your upper hand grasps the foot, pushing the heel toward the buttock.

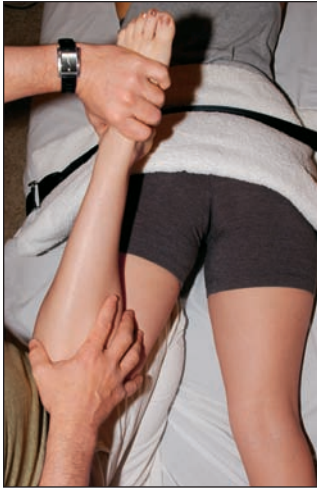


FIGURE 8.72 Assisted foot and extensor stretch

While the client is lying on the stomach, anchor the pelvis with a seat belt (place a cushioned towel as a barrier between the seat belt and the body for added client comfort). Place your knee underneath the client's thigh. Your lower hand supports the knee, keeping it aligned, while your upper hand grasps the foot, pushing the heel toward the buttock. Now grasp the foot and toes with both hands, and flex downward toward the buttock.



FIGURE 8.73 Assisted foot and extensor stretch

While the client is lying on the back, position the client's pelvis at the bottom of the table. Stabilize the spine to prevent arching of the spine, flex the hip and knee, and rest the foot on your chest while supporting the bend of the knee with one hand. Place your other hand on the

client's lower thigh above the knee. Push the fallen leg toward the floor while stabilizing the ankle with your leg to maintain proper alignment.

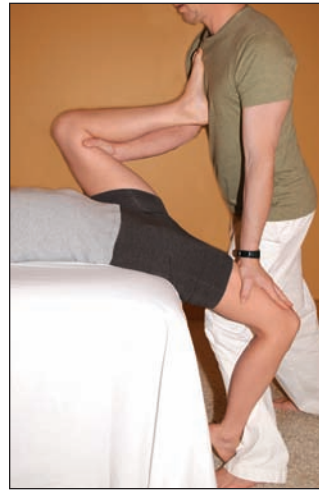


FIGURE 8.74 Assisted hip flexor stretch

While the client is lying on the back, anchor the pelvis with a seat belt (place a cushioned towel between the seat belt and the body for added client comfort). The nonstretched leg hangs off the side of the table for stabilizing. Grasp the heel while supporting the knee, pushing the leg out and down toward the floor.



FIGURE 8.75 Assisted adductor stretch (anchored with seat belt)

The client is in the side-lying position with the lower leg flexed 90 degrees at the hip. Place your upper hand across the posterior pelvis to stabilize the pelvis, and place your lower hand on the anterior lower thigh, just

above the knee. Hyperextend the upper leg by pulling it back, stretching the hip flexors. Keeping the leg straight will isolate primarily the flexors of the hip, whereas flexing the knee while stretching the hip flexors will also engage the stretch to the quadriceps femoris muscles. These stretches are highly effective and should be performed with a focused intent to ensure the quality of the stretch. Effectiveness and quality are achieved by stretching slowly while communicating with the client in regard to maintaining the client's comfort level.



FIGURE 8.76 Assisted hip flexor stretch (with rope)

This is the most effective stretch when an assistant is available to help stabilize the client's pelvis; the lower leg is flexed and supported by the assistant's thigh. This allows you to focus strictly on the stretch and to maneuver the stretched leg into different positions for angling the leg and for isolating and performing a thorough stretch of the hip flexors.



FIGURE 8.77 Two-person assisted hip flexor stretch

BRIEF SUMMARY

The anterior lower-extremity compartment (ALEC) is a chain of muscles and fasciae that arise from the dorsal surface of the foot and travel upward, attaching to the lower leg, thigh, and pelvis; the ALEC contains the only muscle (the psoas) that directly links the leg to the spine. Muscular imbalances, repetitive injuries, and direct trauma affect many joints of the foot, ankle, knee, hip, pelvis, and spine. Treatment to the ALEC is delivered in sequence, with treatments starting at the foot and ankle and proceeding to the leg and groin.

The Clinical Notes boxes in this chapter cover muscular imbalances that affect posture and pain. The Routine boxes and their illustrations provide guidance for proper hand placements for delivering effective therapy techniques. The Stretching box demonstrates specific stretching techniques that are safe, effective, and easy to do.

REVIEW QUESTIONS

1. Pain in the great toe can be a referral from what muscle?

2. The lateral malleolus is the large bony landmark that serves as a leverage point for the peroneal muscles to pull the lateral side of the foot upward producing what movement?

3. Name the two primary inverters of the foot.

4. The anterior inferior iliac spine (AIIS) is a bony landmark that attaches what muscle?

5. When administering massage/bodywork techniques to the inner thigh, advising your client to wear undergarments along with proper draping will ensure what?

6. List the three main nerves that supply the anterior thigh, medial thigh, and posterior thigh.

7. List the three muscles that attach to the medial proximal tibial shaft known as the pes anserinus.

8. The interweaving fibers that form the strong tendinous iliotibial band prevent the knee collapsing or buckling in what direction?

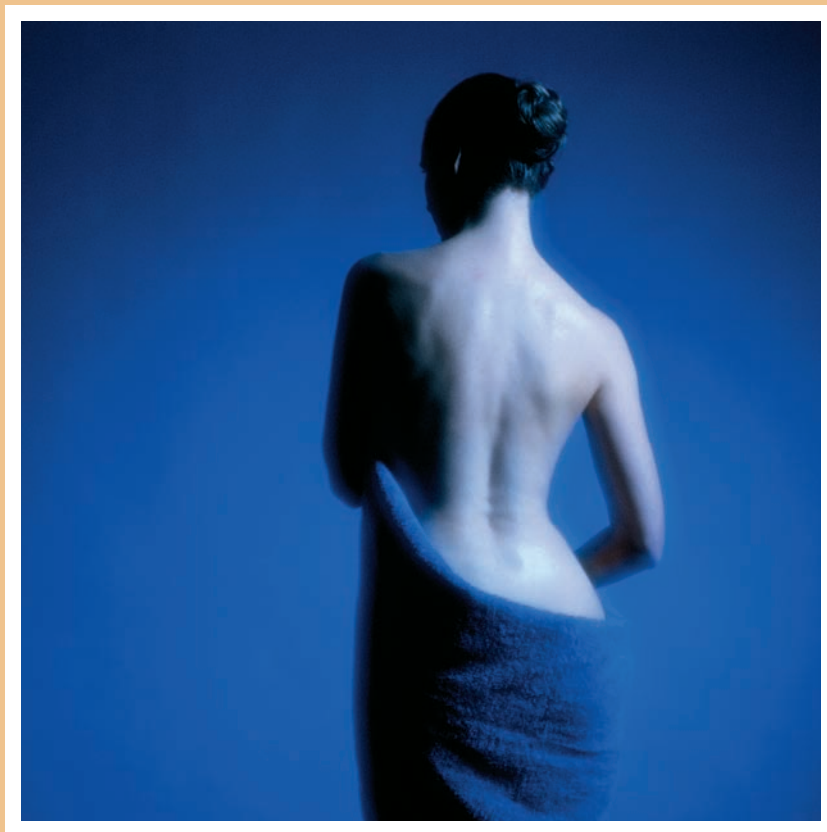
9. Medial thigh and knee pain and limited range of motion during abduction of the leg at the hip joint are primary symptoms of what muscle group?

10. What adductor muscle assists hip flexion and hip extension movements?

CRITICAL-THINKING QUESTIONS

A client complains of medial knee pain. The client's patella movement is limited and postoperative scarring is visible, indicating a previous surgery.

1. Which muscle groups would you isolate and apply massage therapy to?
2. What are some other things you can suggest to the client to assist in recovery?



CHAPTER 9
POSTERIOR TORSO COMPARTMENT
(PTC)

LEARNING OUTCOMES

After completing this chapter, you will be able to:

- 9.1 List and identify the muscles of the PTC.
- 9.2 Define the origins and insertions of the muscles of the PTC.
- 9.3 Describe the actions of the PTC.
- 9.4 Recognize the pain patterns of the PTC.
- 9.5 Discuss the clinical notes for and the importance of treating the muscles of the PTC.
- 9.6 Demonstrate client positioning and treatment routines of the PTC.
- 9.7 Demonstrate safe and effective stretching techniques for the muscles of the PTC.

OVERVIEW

The posterior torso compartment (PTC) includes muscles that are linked to many painful conditions often associated with both the upward, elevated “arched” posture and the downward, collapsed “stooped” posture. Keep in mind that there are many variations of muscular imbalances that can lead to painful conditions and/or dysfunction. Preconceived “one size fits all” notions, especially in the field of posture and structure, more accurately end up as “one size fits no one.”

Using overgeneralized postural assessment guidelines makes it too easy to make quick assumptions based on superficial appearances that mask the client’s inner structural reality. Very often, postural distortions that appear to be similar cause a therapist to treat various conditions such as unleveled iliums, uneven leg lengths, tilted shoulder girdles, so-called but usually misnamed sway-back, muscles resisting a stooped posture, and suboccipital compression. However, such distortions often have causes that are very different from what the inexperienced therapist assumes.

In addition, preformulated assumptions about posture and pain very often mislead a therapist into isolating and focusing on the localized site of pain and dysfunction. The therapist applies deep, vigorous, overstimulating treatment to painful tissues, and in many instances the pain goes away. More often than not, however, the painful condition returns week after week or even gets worse. Occasionally, because the therapist has been releasing the painful but reactive muscles rather than the causative muscles, the client suffers varying degrees of tissue damage.

It is true that many neuromuscular, myofascial, and musculoskeletal problems are localized in nature and can be resolved with specific, localized pressure on the damaged tissue. Yet many of the painful or dysfunctional conditions manifesting in the posterior torso compartment are better addressed with insights from a more comprehensive view of structural bodywork. This entails seeking the primary contractors—the locked-short muscles that are often on the opposite side or end of the body from the area where the pain or dysfunction manifests. For example, pain and dysfunction in the posterior torso are often the result of overshortening of muscles in the anterior compartment of the torso or in the posterior lower-extremity compartment of the hips and thighs.

Prolonged sitting and standing with bad posture, excessive heavy lifting, counterbalancing, and stabilizing weight distribution on movement, as well as the opposing force of gravity when the body leans or slouches forward—all have a significant effect on the spinal erector muscles.

The trapezius and the rhomboid muscles, and others, are always symptomatic when muscular imbalances of the scapula are left untreated. These muscles are frequently involved with mid- to upper-back pain. The levator scapulae, splenius cervicis, and splenius capitis muscles underlie the upper half of the trapezius and are often involved in persistent neck problems that cause sharp pain and limit head and neck movements.

The posterior suboccipital muscles controlling specific movements of the upper two cervical joints and head often harbor trigger points that refer symptoms of a tension headache. The base of the occipital ridge and the upper two cervical joints are ideally located for students to enhance their palpatory skills and apply a variety of subtle energy techniques.

The massage/bodywork techniques in this chapter will teach students how to achieve maximum client results when addressing the PTC muscles with effective assessment and treatment techniques.

CLINICAL SUCCESS

A professional golfer complained of acute back pain sustained from a lumbar strain/sprain injury. His body was examined, and a leg-length deviation was discovered: His left leg was a half-inch shorter than his right leg. The pain pattern was unilateral, limited to the shorter left side, and located on the superior crest of the ilium with spillover pain into the back-pocket region of the buttock. The pain pattern was typical of a quadratus lumborum injury with a functional short leg on the same side. The quadratus lumborum was thought to be the most likely source of the pain. S-curve scoliosis was observed with the left hip elevated, left shoulder girdle elevated, and right shoulder girdle depressed. The objective was to isolate and lengthen the quadratus lumborum muscle and others on the side of the elevated ilium, as well as the muscles higher up on the concave sides of the spine.

The client was treated in the side-lying position with a bolster placed underneath the waist to open up the lumbar angle from the rib cage and the iliac crest, expose the quadratus lumborum, and prevent the spine from dipping into a collapsing concavity. The obliques, latissimus dorsi, quadratus lumborum, and lower sections of the erector spinae were isolated and treated to open up the space between the pelvis and the rib cage and to level the pelvis; the deep muscles of the lamina were isolated and treated to reduce the intrajoint pressure of the spine's facet joints. Releasing the deep rotational muscles of the spine allowed optimal trunk rotation, which in turn enabled better functioning of the spinal facet joints and muscles. Next, the treatment plan consisted of moving up to the opposite side of the spine and lengthening the latissimus dorsi and other muscles that were directly involved with depressing the opposite shoulder.

Because the client presented with a functional S-curve scoliosis, treatment again reverted back across the spine to include lengthening the muscles elevating the shoulder—primarily the trapezius and the levator scapulae muscles.

The initial primary focus on and treatment to the quadratus lumborum leveled the client's pelvis and decreased the client's pain of the lumbar and iliac crests significantly. Treatment to the muscles higher up on the concave sides of the spine had a positive effect, as it leveled the client's shoulder girdles and increased the client's cervical range of motion without pain being present. The client stated that he felt an increased awareness of his body's being level and stable, with a marked reduction of his overall pain symptoms.

ERECTOR SPINAE, FIGURE 9.1

ORIGIN Sacrum by way of thoracolumbar aponeurosis, multiple vertebral processes of the spinal column and the posterior rib cage

INSERTION Upper posterior rib cage, multiple vertebral processes of the thoracocervical spine, occipital bone and mastoid process of temporal bone

ACTION *Bilaterally:* extends the spine
Unilaterally: laterally flexes the spine

MYOTOME Spinal nerves

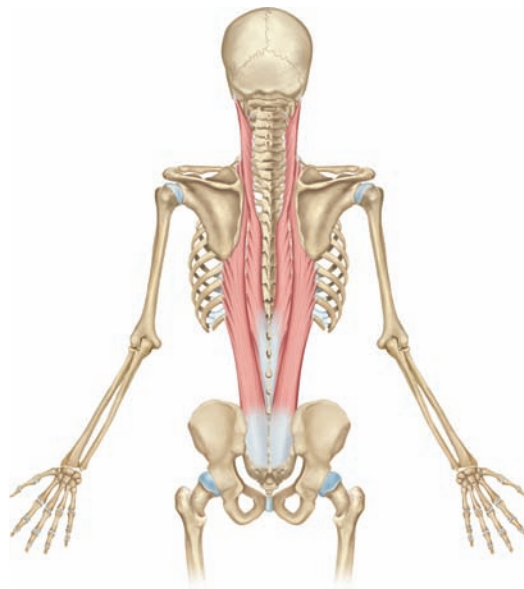


FIGURE 9.1a **Erector Spinae Muscle**

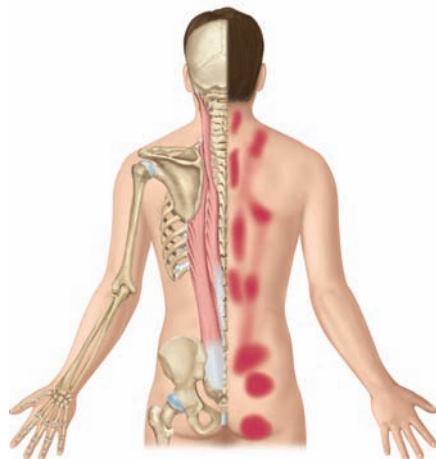


FIGURE 9.1b **Erector Spinae Muscle and Referred Pain Pattern**

CLINICAL NOTES: Erector Spinae

The groups of paraspinal muscles that attach vertically and posteriorly along each side of the spine, connecting the spine and pelvis to the rib cage and skull, are known as the *erector spinae muscle group*. The erector spinae is anchored to the sacrum and spine by a strong, thickened layer of fascia called an *aponeurosis*. There are two muscle segments on each side of the spine (spinal and costal) that are further divided into three regions (lumbar, thoracic, and cervical), for a total of six divisions. Each division has multiple tendinous attachments on the posterior rib cage and vertebral processes of the spine and controls the action of that specific spinal column region. Acting unilaterally (all divisions acting as a group on one side of the spine), the primary function of the erector spinae is lateral flexion to the side of the contracting muscle group. Acting bilaterally, the primary function is extension of the spine.

The erector spinae have a substantial influence on spinal alignment, vertebral function, and overall posture and are directly or indirectly involved with all postural distortion. One mode of influence originates from habitual body patterns of behavior, as seen, for example, in gymnasts or ballerinas. Their upward, elevated, and “arched” postures are structurally conditioned, often originating from chronic muscle tension within the lumbar and lower thoracic regions of the erector spinae. The shortened muscle fibers of the erector spinae pull the sacrum upward, increasing the appearance of an overall arc or arch of the lumbar and lower thoracic spine. (See Chapter 7, page 177, on pseudolordosis to review potential misconceptions regarding the actual curvature of the lumbar vertebrae, which is often the opposite of outer appearances.)

The quadratus lumborum, serratus posterior inferior, and latissimus dorsi muscles also contribute significantly to the structurally conditioned arched appearance of a gymnast. The latissimus dorsi pulling the shoulder girdles down and back, the serratus posterior inferior pulling the lower four ribs down and back, the erector spinae pulling the sacrum upward, and the quadratus lumborum pulling the pelvis upward collectively contribute to lumbar and lower thoracic arching of the spine (but in many cases, and paradoxically, it is not necessarily a true, excess lumbar lordosis). A dipping or “scooping in” of the spinal vertebrae often shows up at the level of L1 thru T10, which are susceptible to becoming compressed and fixated. A decrease or loss of thoracic curve and the “fanning open” of the rib cage are very common and indicative of this arching posture. It must be cautioned that this very upright external appearance often leads a therapist to falsely assume that the client has comparatively good posture.

On the flip side and often misunderstood, a most prevalent cause of back pain is the downward, collapsed “stooped” posture. When hip extensors and trunk flexors, which often go unnoticed as the root cause of back pain, are locked in a shortened position, this imbalance causes an opposing compensatory reaction in the erector spinae and other muscles. As they contract, resisting the downward pull of gravity as the upper torso projects forward and down, the erector spinae often become tension-overloaded, neurologically exhausted, and chronically painful. This is often misunderstood as weakness.

ROUTINE: Erector Spinae

Position of client: seated, with a pillow folded and placed underneath the abdomen. Have the client lean forward and stretch over the massage table. (See Figure 9.2.)

If scoliosis is present, treatment should be more thorough on the concave sides of the spinal column.

1. Using the fingertips, treat the posterior torso compartment with slow, deep effleurage from the sacrum to the occiput.
2. Using the fingertips, treat the individual segments of the erector spinae with compression, moving in 1-inch segments. When proceeding deeper into the muscle layers, apply pressure that is penetrating but controlled to avoid slipping off the lateral edges of the individual muscle segments. Treat both spinal and costal divisions. (See Figure 9.3.)
3. Stand on one side of the client. Using your body weight and contoured hands, apply broad deep compression and myofascial stretching from the midline, moving laterally across the rib cage. Then apply slow, deep, and rhythmical cross-fiber friction to the erector spinae on the opposite side, frictioning away from the spine. Treat both spinal and costal divisions. (See Figure 9.4.)

Repeat on the other side.

4. Using the olecranon process of the elbow, treat the separate divisions of the erector spinae group with slow, deep, and isolated compressions. Slightly reduce pressure when gliding to the next treatment site. When hypersensitive tissues are communicated by the client, stop and slowly compress. As you and the client “play the edge,” continue with deeper compressions until a substantial softening of the muscle occurs. Continue this process of glide, compress, and release throughout the entire treatment. (See Figure 9.5.)
5. Glide in 6-inch segments, stopping and compressing where tension is felt. Continue this procedure with a focused intent to maintain the client’s comfort.



FIGURE 9.2



FIGURE 9.3

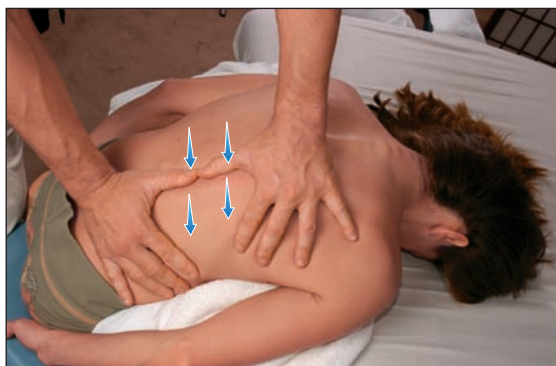


FIGURE 9.4



FIGURE 9.5

MULTIFIDI AND ROTATOIRES

MULTIFIDI, FIGURES 9.6 AND 9.7

ORIGIN	Sacrum, medial body of lumbar transverse processes, lateral tip of thoracic vertebrae, and articular processes of last four cervical vertebrae
INSERTION	Spinous processes of all vertebrae excluding C1 (atlas)
ACTION	<i>Bilaterally:</i> extends the spine <i>Unilaterally:</i> rotates the spine to the opposite side
MYOTOME	Spinal nerves

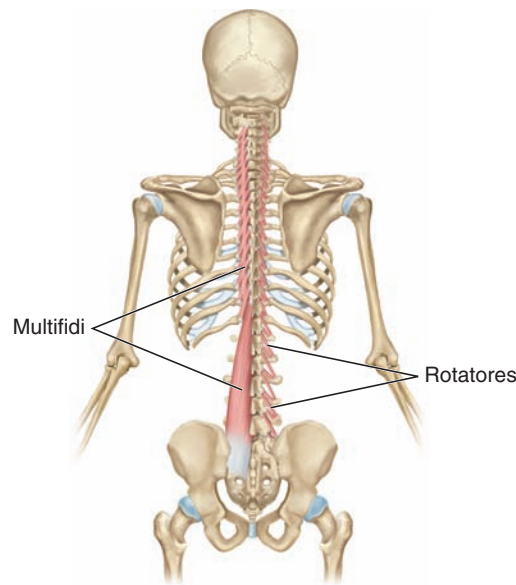


FIGURE 9.6 **Multifidi and Rotatores Muscles**

ROTATOIRES FIGURES 9.6 AND 9.7

ORIGIN	Transverse processes of all vertebrae excluding C1, C2, and C3
INSERTION	Spinous processes of all vertebrae excluding C1 (atlas)
ACTION	<i>Bilaterally:</i> extends the spine <i>Unilaterally:</i> rotates the spine to the opposite side
MYOTOME	Spinal nerves

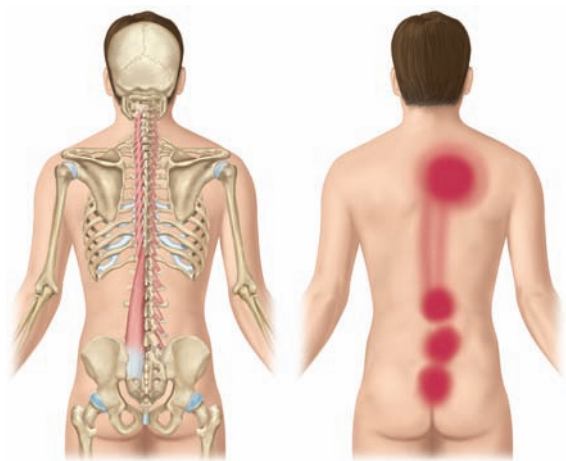


FIGURE 9.7 **Multifidi and Rotatores Muscles and Referred Pain Pattern**

CLINICAL NOTES: Multifidi and Rotatores

The multifidi and rotatores are known as the *deep paraspinals*. They lie within the lamina groove of the spine, deep and medial to the spinal segment of the erector spinae. The deep paraspinals span one to four facet joints and specifically control the finer movements of the spinal joints. Acting bilaterally, the multifidi and rotatores work with the erector spinae to extend the spine. Acting unilaterally, the diagonal fibers of the deep paraspinals serve as primary extensors, rotators, and stabilizers of the facet joints of the spinal column.

Restrictions in movement, aching, and persistent pain around the spinous processes of the vertebrae can be the result of muscular imbalance in the deep paraspinals. Hilton's law explains why the myofascia overlying the involved segments of the spine may be hypersensitive and will often elicit pain and an acute resistance to fascial manipulation if the problem is, in fact, musculoskeletal. If hypertonic deep paraspinals are left untreated, these muscles can cause a twisting of the spinal column called *roto-scoliosis*.

When treating clients with paraspinal problems, it is a good practice to work in conjunction with a physician who specializes in spinal manipulation. The client could benefit from a structural diagnostic assessment that may include x-rays and a treatment regime including spinal adjustments.

ROUTINE: Multifidi and Rotatores

Position of client: prone.

1. Using contoured palms and fingertips, treat the posterior torso compartment with slow, deep effleurage from the sacrum to the occiput.
2. Using the index knuckle, treat the multifidi and rotatores within the lamina groove with compression and friction moving in 1-inch segments. (See Figure 9.8.)

There are a variety of massage tools that are useful in delivering isolated compressions into smaller body indentations.

3. Angle a T-bar at a 45-degree angle into the lamina groove, and friction in 1-inch segments. Stabilize the T-bar with your thumb and index finger, fanning your other fingers for added support, while the thumb of the other hand stabilizes the T-bar and guides it to the next contact point. *Note:* It is important to keep the T-bar level when you are applying compression and friction. Avoid tilting the T-bar and gouging into the tissues. Friction should be performed smoothly and rhythmically. (See Figure 9.9.)
4. Using the fingertips or thumbs, treat the multifidi and rotatores with compression and friction at a 45-degree angle, staying medial to the erector spinae butting up against the spinous processes. Next, move laterally (about a thumb width), crossing over the erector spinae. Continue compression and friction, this time applying pressure down toward the transverse processes. *Note:* The objective is to isolate and treat as much of the deeper paraspinals as possible without having to penetrate through the erector spinae. (See Figure 9.10.)
5. Compress the muscles of the back with alternating pressure, moving in a superior and lateral direction over the rib cage. This myofascial “rocking” helps to release areas that may be fixated or stuck in the thoracic region. (See Figure 9.11.)



FIGURE 9.8



FIGURE 9.9



FIGURE 9.10



FIGURE 9.11

QUADRATUS LUMBORUM, FIGURES 9.12 AND 9.13

ORIGIN 12th rib, transverse processes of L1 through L4

INSERTION Iliac crest

ACTION Laterally flexes the vertebral column

MYOTOME T12, L1

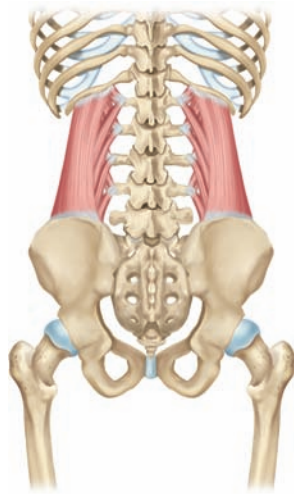


FIGURE 9.12 **Quadratus Lumborum Muscle**



FIGURE 9.13 **Quadratus Lumborum Muscle and Referred Pain Pattern**

CLINICAL NOTES: Quadratus Lumborum

The quadratus lumborum muscle has (in most people) three muscular divisions running in different directions on each side of the spine:

- Vertical iliocostal segment that runs from the 12th rib to the crest of the ilium.
- Diagonal iliolumbar segment that runs from the transverse processes of the upper four lumbar vertebrae to the crest of the ilium.
- Diagonal lumbocostal segment that runs from the transverse processes of the upper four lumbar vertebrae to the 12th rib.

Each of these divisional layers should, to the degree possible, be assessed and treated as separate muscles. This approach provides a more direct examination of and thorough treatment to the individual muscle layers and fibers—fibers that could be harboring trigger points often eliciting pain. It also allows direct isolation of the exact muscular division that may be contributing to a local articular dysfunction of the spine, which could be easily overlooked using standard stroking techniques that merely glide over the surface tissues, missing the deeper fibers altogether.

The iliolumbar ligament attaches to the transverse process of the 5th lumbar vertebra to the crest of the ilium. The iliolumbar ligaments lie directly below the quadratus lumborum on each side of the spine and are perfectly positioned for stabilizing the lumbar spine to the pelvis. Since the fibers of the iliolumbar ligament interdigitate with those of the lower fibers of the quadratus lumborum on the superior surface of the iliac crest, they can be considered an extension of one another as postural stabilizers.

The quadratus lumborum assists the erector spinae in lumbar spine extension. It is also to a great degree a lateral flexor of the lumbar spine, assisted by the obliques, psoas, erector spinae, and latissimus dorsi.

A strain injury to the quadratus lumborum can be debilitating and disruptive of one's daily activities. An injury to this postural stabilizer has the ability to throw the entire body out of pelvic and spinal alignment. Shortening of the quadratus lumborum can hike the ilium upward, creating an upward shearing of the sacroiliac joint, unleveling the pelvis and leg lengths, and thus facilitating a functional short leg on the side of the injury. A quadratus lumborum imbalance (one side being shorter than the other) potentially causes a compensatory reaction of the muscles higher up and, therefore, a compensatory functional scoliosis. These pelvic and spinal misalignments often perpetuate weakening, instability, and pain in the back and pelvis.

The quadratus lumborum refers pain along the iliac crest and into the sacroiliac and gluteal regions of the body.

Referred pain is localized around the hip pocket and seldom travels beyond the gluteal fold, unlike referred pain from other muscles, articular dysfunction of the sacroiliac joint, or an inflamed disk that has migrated into the nerve root—all cases in which pain can travel down the leg. Pain resulting

from an acute injury to the quadratus lumborum can be immobilizing. Pain will be notable when the client is in a sitting position, and pain can be excruciating when walking. Ambulation may be easier when crawling on all fours. It can become almost impossible to find a comfortable position to sleep in. The severity of pain, whether in an upright or non-weight-bearing position, is persistent.

Treatment for injury involving the quadratus lumborum should include a wraparound Velcro support brace during the acute phase, as well as collaboration with a physician specializing in spinal manipulation to maintain mobility of the joints and education about ways to prevent reinjury. A consistent stretching routine (often requiring a minimum-edge approach) and elimination of unnecessary twisting and bending movements can help prevent further aggravation of the muscle.

ROUTINE: Quadratus Lumborum

Position of client: prone.

1. Using the fingertips, fall off the erector spinae laterally. This places your fingertips at the location of the quadratus lumborum. Apply slow, deep compression, ending with myofascial spreading with hands moving in opposite directions. (See Figure 9.14.)
2. Using the thumbs, treat with slow, deep effleurage from the iliac crest to the 12th rib. (See Figure 9.15.)
3. Using the fingertips, fall off the erector spinae laterally, directly below the 12th rib. This places your fingertips at the location of the lumbocostal division of the quadratus lumborum. Treat with slow, deep compression, moving in 1-inch segments along the inferior border of the 12th rib. (See Figure 9.16.)
4. Using the thumbs, isolate the iliocostal division of the quadratus lumborum about a thumb width, lateral to the lumbar transverse processes of L1 through L4. Treat with static compression at each contact point. Apply parallel friction, moving in 1-inch segments slowly and rhythmically from the iliac crest toward the 12th rib. (See Figure 9.17.)



FIGURE 9.14



FIGURE 9.15



FIGURE 9.16

5. Using the thumbs, isolate the iliolumbar division of the quadratus lumborum. Treat with slow, deep static compression, moving in 1-inch segments at each contact point along the superior border of the iliac crest. (See Figure 9.18.)
6. Using the thumbs, isolate the iliolumbar ligament, between the medial superior border of the iliac crest and the transverse process of L5. Treat with deep static compression and then friction, moving in 1-inch segments. (See Figure 9.19.)



FIGURE 9.17



FIGURE 9.18



FIGURE 9.19

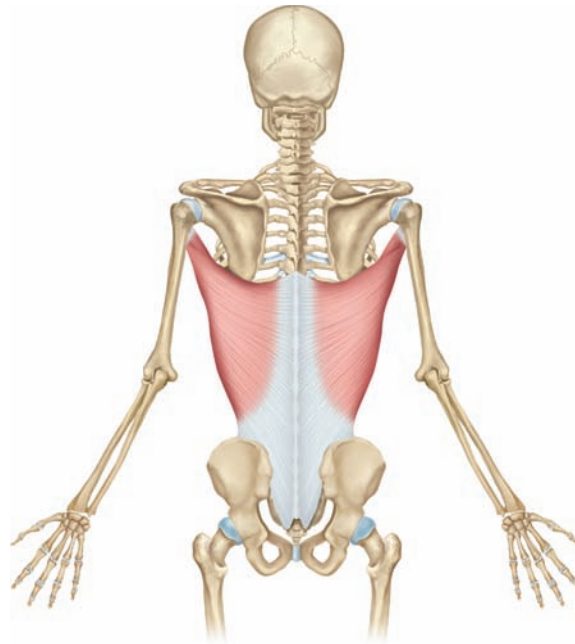
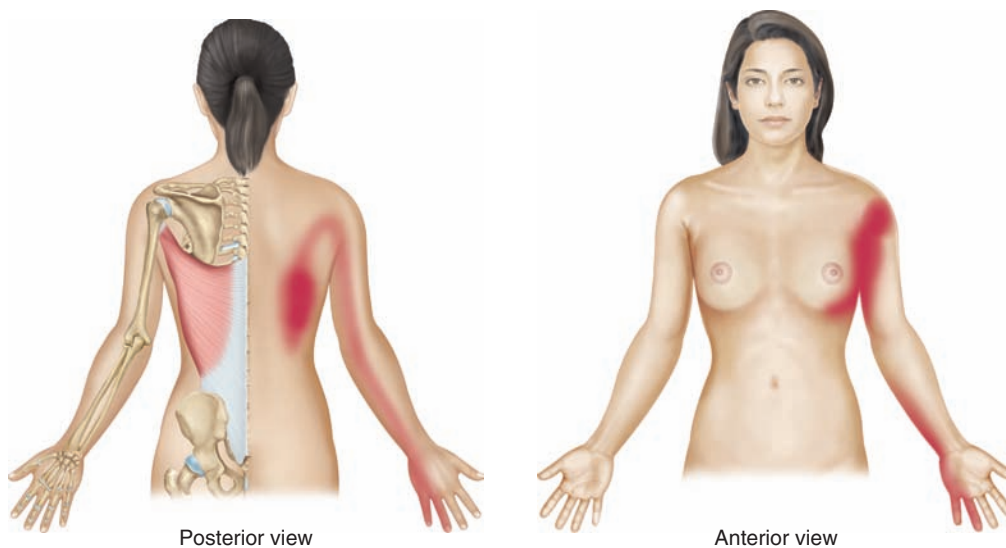
LATISSIMUS DORSI, FIGURES 9.20 AND 9.21

ORIGIN By way of an aponeurosis attaching to the iliac crest and sacrum, the lower three to four ribs; the spinous processes of the lumbar and lower six thoracic vertebrae; and the inferior angle of the scapula

INSERTION Intertubercular (bicipital) groove of the humerus

ACTION Extends, medially rotates, and adducts the humerus

MYOTOME Thoracodorsal nerve C6–C8

FIGURE 9.20 **Latissimus Dorsi Muscle**FIGURE 9.21 **Latissimus Dorsi Muscle and Referred Pain Patterns****CLINICAL NOTES:** Latissimus Dorsi

The latissimus dorsi is a superficial and powerful muscle with multiple attachment sites via a thick, fibrous tissue called *aponeurosis* that extends from the posterior iliac crest, sacrum, and spinous processes of the lumbar spine and lower six vertebrae of the thoracic spine. Fibers originating from the pelvis run vertically and merge with the oblique fibers of the lumbar spine, continuing in a superior direction, where they merge with the horizontal fibers of the thoracic spine. The latissimus dorsi

fibers become a muscular band that anchors and stabilizes the scapula to the rib cage as it merges with the teres major to form the posterior axillary contour of the body; the pectoralis major forms the anterior contour. The latissimus dorsi then travels to the site of insertion located on the anterior proximal shaft of the humerus, twisting approximately 180 degrees.

The functions of the latissimus dorsi include adduction, extension, and medial rotation of the humerus at the shoulder joint, as well as forceful depression of the shoulder girdle from its attachment on the humerus. The latissimus dorsi is the only muscle with attachment sites on the pelvis, spine, and humerus; therefore, treatment of this muscle is extremely important when you are attempting to restore proper postural alignment.

The subscapularis muscle, being the primary medial rotator of the arm at the shoulder joint, and the latissimus dorsi muscle, which covers much of the mid- to lower back, have a strong ability to irritate local nerves and tissues and restrict abduction and lateral movements of the arm at the shoulder joint. This is seen with many sports-related injuries to the rotator cuff muscles.

The teres major and pectoralis major should also be considered in the assessment and treatment of shoulder injuries, as they also contribute to medial rotation of the arm at the shoulder.

Imbalance of shoulder muscles (medial rotatores being shorter than the lateral rotatores) can result in displacement of the head of the humerus anteriorly within the joint capsule, causing an impinging pain and joint compression on flexion, abduction, and external rotating movements of the arm at the shoulder. If left untreated, myofascial imbalance in this area can end up leading to chronic tendonitis, bursitis, and joint capsulitis of the shoulder.

A treatment plan should also include a daily stretching program.

Muscular Components of Collapsed Stooped Posture

Bilateral Distortion (Front to Back)

The latissimus dorsi, erector spinae, and quadratus lumborum are a few of the larger muscles opposing and resisting the downward, collapsed stooped posture. As the upper torso moves forward in space and off the gravitational line of balance, the lower fibers of the erector spinae a.) pull the sacrum up, b.) pull the lower lumbar vertebrae posterior and downward, and c.) compress the posterior aspects of the lower lumbar facet joints. In some cases, they d.) cause the lumbosacral joint to push forward, creating a “kinking” action, showing up as the arched appearance of a pseudo-lordosis.

The lower fibers of the trapezius overlie the upper fibers of the latissimus dorsi and—by virtue of their close proximity and their scapular attachments—when shortened, depress and retract the scapulae (down and back), often flattening the thoracic spine and restricting scapular mobility.

The erector spinae, quadratus lumborum, and latissimus dorsi, along with the lower fibers of the trapezius muscles that counteract the forces of the downward, collapsed stooped posture, are the most prevalent, overworked, and painful muscles of the back and the ones most commonly and mistakenly treated—unless, of course, the true cause of pain actually originates within the muscles themselves.

Muscular Components of Functional Scoliosis

Unilateral Distortion (Side to Side)

All muscular imbalances that create a side-to-side asymmetry involve, one way or the other, the erector spinae, the quadratus lumborum, and the latissimus dorsi. Chronic unilateral shortening of any one of these muscles—whether stemming from an old injury that was left unnoticed, glanced over, or improperly treated or from a group shortening in sequence from repetitive use, occupational strain, or adaptive or compensatory postures—will predominantly affect either side of the spine, therefore subsequently affecting both sides of the spine. It should be noted that treatment to the shorter muscles found on the concave sides of the spine, not necessarily the painful ones, will better serve in restoring muscular symmetry and postural alignment to a client's body.

ROUTINE: Latissimus Dorsi

Position of client: side-lying, with a bolster under the waist. (See Figure 9.22.)

1. Using contoured hands, apply downward pressure, moving your hands in opposite directions toward the therapy table, stretching the myofascia along the horizontal Langer lines. Have the client focus on deep breathing and relaxation. (See Figure 9.23.)
2. Using the fingertips, treat the latissimus dorsi muscle along the lower ribs with compression. Treat in 1-inch segments, staying parallel to the ribs. Treat lateral to medial (all the way around to the midline of the back, from pelvis to T6) with slow, deep fingertip effleurage. (See Figure 9.24.)

Rotate the client's trunk 90 degrees while keeping the client's upper body prone. Fully extend the client's top leg off the table to assist in opening the space between the rib cage and the ilium, lengthening the muscle.

3. Using the fingertips or contoured hands, treat the belly of the latissimus dorsi with a slow, deep myofascial glide from the posterior iliac crest, moving upward and following the lateral border of the scapula to the axillary region.

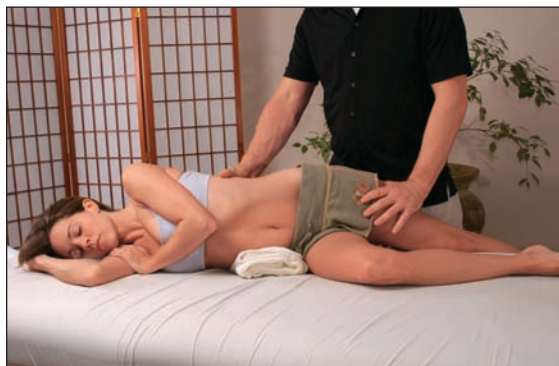


FIGURE 9.22

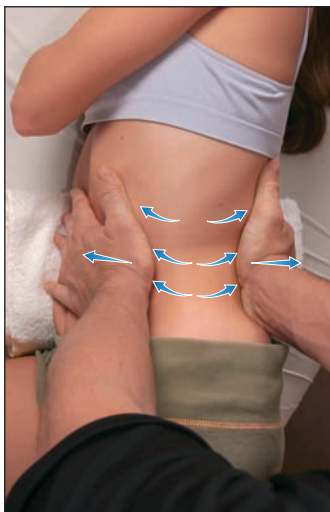


FIGURE 9.23

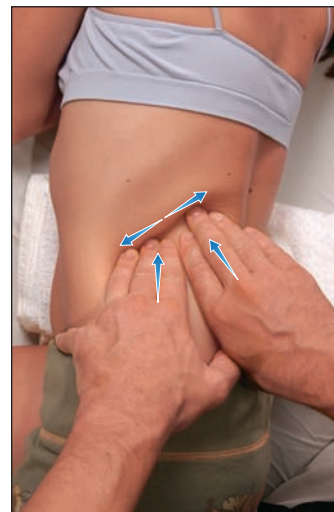


FIGURE 9.24

Caution: Be sure to maintain the client's minimal edge when delivering this technique in this position. Avoid prolonged stretching of this muscle, as well as other spinal muscles, too far, too fast, and too long. (See Figure 9.25.)

Position of client: prone. Stand on the side being treated, at the level of the pelvis.

4. Using full, broad contact with both hands—one stabilizing, the other treating—at the midaxillary line compress in from the side, working the latissimus dorsi and myofascia back toward the spine. Treat muscular restrictions by applying slow, deep fingertip compression to the exact site. Maintain pressure, and then slowly apply friction, moving in 1-inch segments. Reposition your hands at each contact site, and continue treatment from the pelvis to the axillary fold. (See Figure 9.26.)

Move and re-treat the opposite side of the body.

5. Reach across the client's body, and isolate the belly of the latissimus dorsi by picking up and pulling the entire muscle bundle toward you. Pinch and compress the muscle fibers. As the muscle fibers soften and release, add friction as you pinch and compress each contact site. Grasp as much muscle belly as possible when compressing the latissimus dorsi. This allows a broader and more complete treatment. (See Figure 9.27.)

Position of client: side-lying.

6. Isolate the latissimus dorsi and teres major at the axillary fold. Pinch and compress the muscle fibers. As they soften and release, add friction as you pinch and compress each contact site. Grasp as much muscle belly as possible for a broader and more complete treatment. (See Figure 9.28.)



FIGURE 9.25



FIGURE 9.26

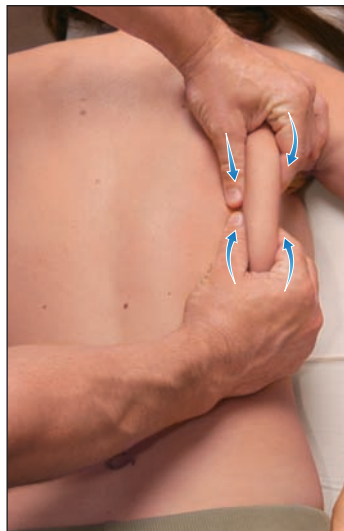


FIGURE 9.27

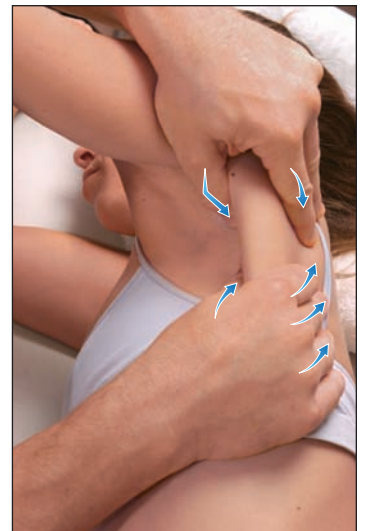


FIGURE 9.28

TERES MAJOR, FIGURES 9.29 AND 9.30

ORIGIN Inferior angle of the scapula

INSERTION Fuses with latissimus to attach at and around the intertubercular (bicipital) groove of the humerus

ACTION As “helper to the lats,” shares the actions of extension, medial rotation, and adduction of the humerus

MYOTOME C5–C7

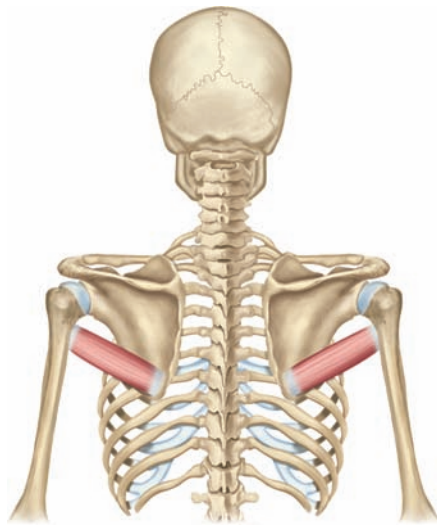


FIGURE 9.29 **Teres Major Muscles**

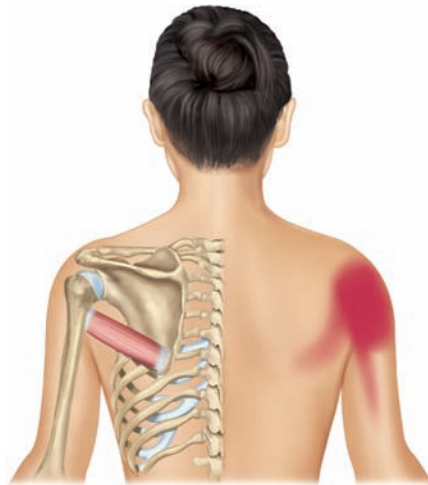


FIGURE 9.30 **Teres Major Muscle and Referred Pain Pattern**

CLINICAL NOTES: Teres Major

The teres major muscle originates on the inferior angle of the scapula and merges with the latissimus dorsi to insert on and around the bicipital groove of the humerus. The teres major assists the subscapularis and latissimus dorsi muscles in medial rotation of the humerus at the shoulder joint.

The entire unit should be treated when pain and limited range of motion in the shoulder joint are present.

Hypertonicity in this unit can result in an anterior slipping and/or displacement of the head of the humerus within the joint capsule. This is usually accompanied by impinging pain on flexion, abduction, and external rotation of the humerus.

ROUTINE: Teres Major

Position of client: side-lying, with the lower leg flexed forward to provide stability. The arm should be over the head or in front of the body. (See Figure 9.31.)

1. Using contoured fingertips, treat the teres major and the latissimus dorsi with slow, deep effleurage directly along the lateral contour of the axillary fold. Hold static compression when the client communicates sensitivity. Maintain the client's edge throughout treatment. (See Figure 9.32.)
2. With contoured hands, stretch the myofascia along the Langer lines, moving your hands horizontally around the client's torso. (See Figure 9.33.)



FIGURE 9.31



FIGURE 9.32

3. Use one hand to support the back. Using the fingertips of the other hand, move from anterior to posterior stretching the latissimus dorsi along the rib cage. Using the fingertips, glide in a superior direction while lifting the latissimus dorsi up and off the rib cage. Continue up and into the axillary fold, treating the teres major. (See Figure 9.34.)
4. Position both hands along the posterior axillary fold. Isolate the latissimus dorsi and teres major. Using the fingertips, pick up the muscles and treat with compression, moving in 1-inch segments. (See Figure 9.35.)
5. Using the fingertips or thumbs, press straight in toward the therapy table to explore and treat the lateral abdominal wall from the iliac crest to the 12th rib. Treat in both directions. This will assist in lengthening the lateral torso, opening up the area. (See Figure 9.36.)
6. Using the fingertips, treat the latissimus dorsi and teres major with myofascial continuity, separating the muscular divisions. (See Figure 9.37.)
7. Petrissage the lateral torso muscles.



FIGURE 9.33



FIGURE 9.34

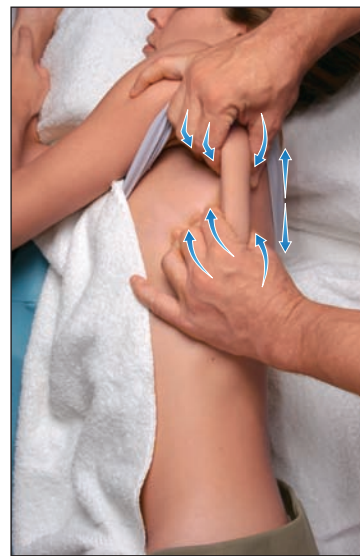


FIGURE 9.35

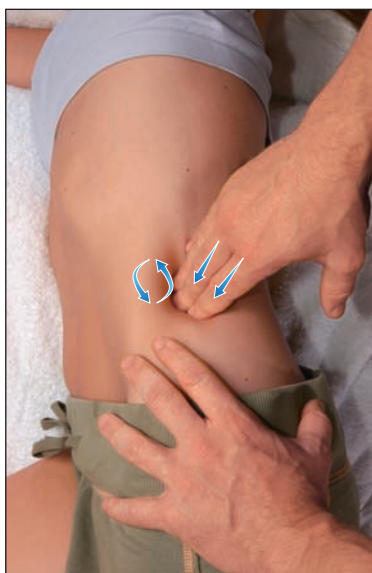


FIGURE 9.36



FIGURE 9.37

SERRATUS POSTERIOR INFERIOR, FIGURES 9.38 AND 9.39

ORIGIN Spinous processes of T11–L2

INSERTION Inferior border of last four ribs

ACTION Pulls ribs down, resisting diaphragm

MYOTOME T9–T12

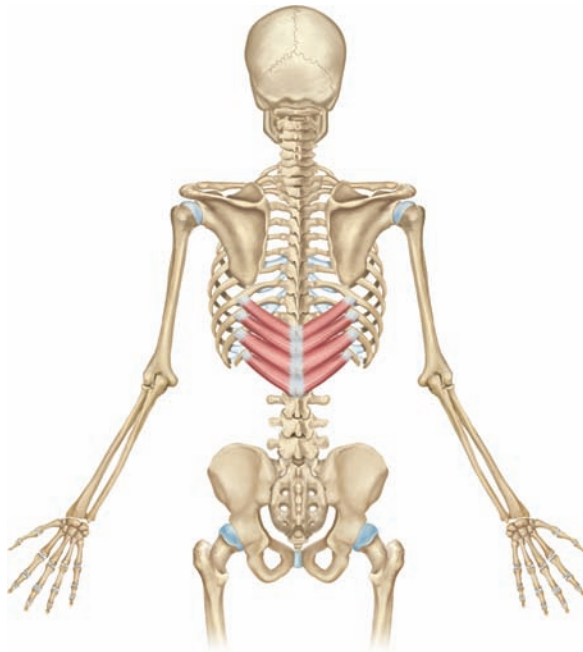


FIGURE 9.38 **Serratus Posterior Inferior Muscle**



FIGURE 9.39 **Serratus Posterior Inferior Muscle and Referred Pain Pattern**

SERRATUS POSTERIOR SUPERIOR, FIGURES 9.40 AND 9.41

ORIGIN	Ligamentum nuchae, spinous processes of C7–T3, supraspinous ligament
INSERTION	Superior border of ribs 2 through 5
ACTION	Raises ribs in inspiration
MYOTOME	T1–T4

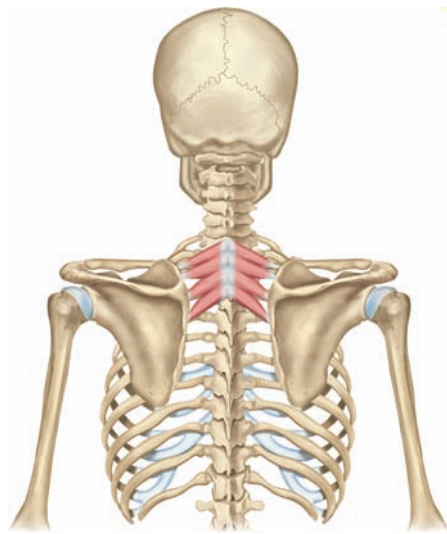


FIGURE 9.40 **Serratus Posterior Superior Muscle**



FIGURE 9.41 **Serratus Posterior Superior Muscle and Referred Pain Pattern**

CLINICAL NOTES: Serratus Posterior Inferior and Superior

The serratus posterior inferior and serratus posterior superior are respiratory muscles. These muscles activate primarily during forced inspiration, resisting the inward pull of the diaphragm. Pain and trigger points often develop in these muscles when poor postural habits are not corrected or after strenuous activity that involves vigorous twisting of the spine. The serratus inferior will often adaptively shorten on the concave side of the spine when the space between the pelvis and shoulder move closer together, as seen with a scoliosis. The same is true for the serratus superior when a concave angle is present. While the pain referral of the serratus inferior is a local deep, dull back pain, the serratus superior refers to the rotator cuff muscles located on the scapula, as well as down the full length of the posterior arm and hand.

ROUTINE: Serratus Posterior Inferior

Position of client: prone.

1. Using the fingertips, treat the muscle in the lamina groove of the thoracic spine. Treat two lines, one being medial to the erector spinae and the other lateral to the erector spinae. This will ensure treatment to the articular surfaces of the spinal facets and ribs. (See Figure 9.42.)
2. Isolate the serratus posterior inferior on the posterior lower rib cage. Using the fingertips and thumb, treat the serratus posterior inferior at the level of the lower four ribs with slow, deep compression and friction, moving in 1-inch segments. (See Figure 9.43.)
3. Isolate the muscle fibers between the ribs. Using the fingertips and thumbs, treat with specific fingertip compression and friction, moving in 1-inch segments.
4. Re-treat any muscle fibers that were hypersensitive or felt restricted with compression and slow, deep effleurage.



FIGURE 9.42

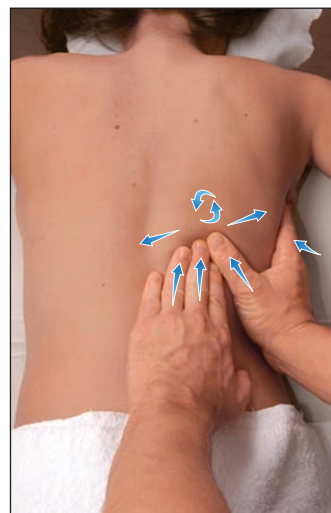


FIGURE 9.43

ROUTINE: Serratus Posterior Superior

Position of client: prone.

1. Using contoured hands and fingertips, administer slow, deep effleurage to the muscles of the posterior torso compartment, working in a superior direction toward the serratus posterior superior. (See Figure 9.44.)
2. Pressing through the superficial layers, apply a downward compression and friction, moving in 1-inch segments from the spinous processes of the spine and moving laterally toward the vertebral border of the scapula. (See Figure 9.45.)
3. Using the fingertips, compress the muscles spanning the lamina groove. Apply parallel friction along the spinous processes from the cervical region down through the upper thoracic region. (See Figure 9.46.)
4. Using fingertips or thumbs, press through the superficial layers, applying a downward static compression toward the articulating surfaces of the ribs and transverse processes. (See Figure 9.47.)

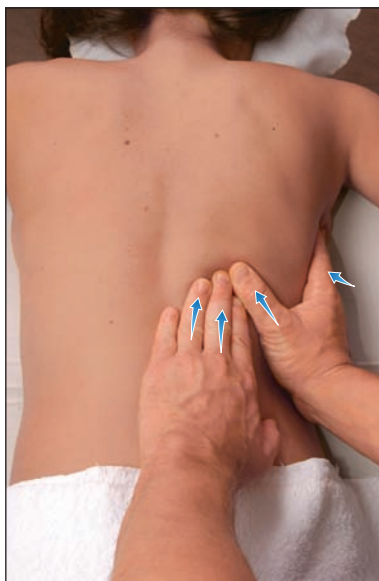


FIGURE 9.44

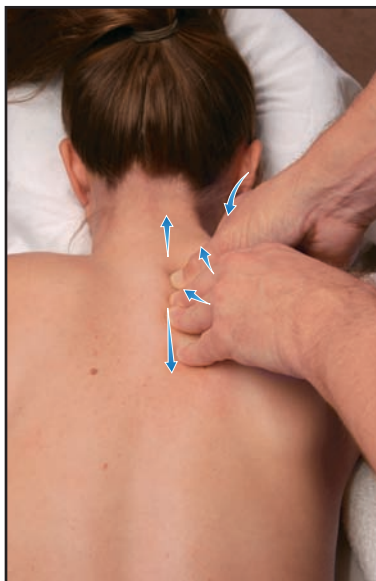


FIGURE 9.45



FIGURE 9.46



FIGURE 9.47

TRAPEZIUS, FIGURES 9.48 AND 9.49

ORIGIN	Ligamentum nuchae from occiput to T12 spinous process
INSERTION	Distal third of clavical, acromion process, spine of scapula
ACTION	Elevates, upper rotates, adducts, or depresses the scapula
MYOTOME	C3, C4

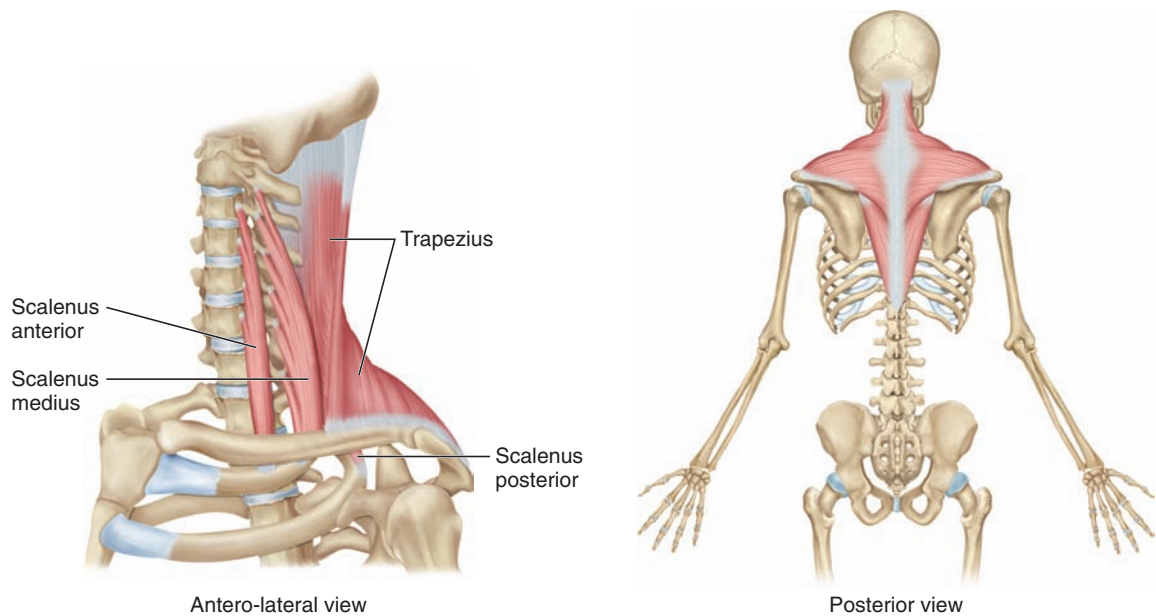


FIGURE 9.48 **Trapezius Muscle**

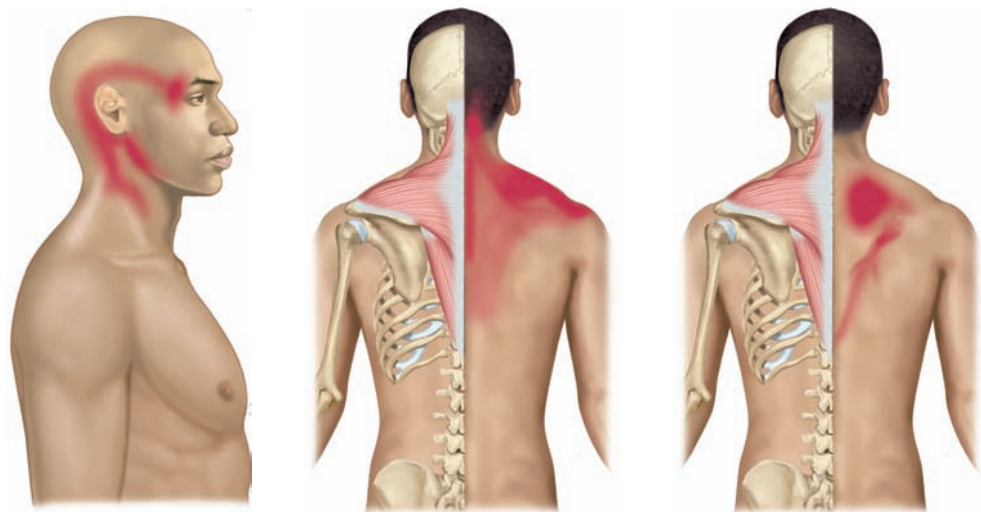


FIGURE 9.49 **Trapezius Muscle and Referred Pain Patterns**

CLINICAL NOTES: Trapezius

The four divisions of the trapezius should be assessed and treated separately, as they travel in different directions and perform different functions.

The first division of the trapezius runs vertically from the occiput, anchoring to the ligamentum nuchae. This division and the posterior cervical muscles should be treated as a functional unit. As a group, they are responsible for head and neck extension. When loss of cervical curve and forward head positioning are present, this group will often become neurologically fatigued and painful as the muscles are perfectly positioned, resisting the weight of the head as it moves down and forward.

The second division of the trapezius originates on the spinous processes and ligamentum nuchae from C3 through C7 and travels obliquely to insert on the distal one-third of the clavicle and acromion process. This division assists the serratus anterior in upward rotation of the scapula.

The first and second divisions of the trapezius and the levator scapulae muscle are responsible for elevation of the shoulder and should be treated as a functional unit when an elevated shoulder is present. This can be an isolated muscular imbalance that directly affects the muscles where the shoulder meets the neck or can be a compensatory reaction to musculoskeletal imbalances lower down on the spine.

The third division of the trapezius originates on the spinous processes and ligamentum nuchae from C7 through T4 and travels horizontally to insert on the spine of the scapula and acromion process. This division assists the rhomboids in retraction of the scapula.

The fourth head of the trapezius originates on the spinous processes and ligamentum nuchae of T4 through T12, travels in a vertical and oblique direction, and anchors on the medial spine of the scapula. This division assists the latissimus dorsi in depression, retraction, and downward rotation of the scapula. When the muscle fibers in this division are overly shortened, they can pull on the spinous processes of the lower thoracic vertebrae, changing the relationship and angle between the adjoining vertebrae above and below one another. This can facilitate spinal facet joint dysfunction and spinal instability.

The lower fibers of the trapezius, the lumbar and lower thoracic fibers of the erector spinae, and the serratus posterior inferior attach to the spinous process of the lumbar and lower thoracic vertebrae and have the ability to cause an increased arc in the spinal region of T9 through L1. This arc or arching of the spine (moving the spinous processes toward one another) posteriorly fans open the ribs anteriorly.

The trapezius muscle can harbor silent trigger points that, when stimulated, cause midscapular and upper lateral shoulder pain and occipital-temporal headaches. The distal fibers of the trapezius can often harbor chronic excess muscle tension toward their attachments on the clavicle, acromion process, and spine of the scapula. Use caution when treating any muscles over and around bony areas, especially when using the elbow. Support the forearm, and treat with slow, precise movements to prevent any unnecessary jolts around bony surfaces or taut muscular bands.

ROUTINE: Trapezius

Position of client: prone.

1. Using the fingertips, treat the muscles of the lamina groove with static compression and friction, moving in 1-inch segments. (See Figure 9.50.)
2. *To treat the first head:* Using the fingers and thumbs, grasp the fibers on each side separately, and slowly compress. If the muscles are adherent, compress and friction the posterior cervicals as a whole, thereby influencing the left and right upper trapezius muscles. (See Figure 9.51.)
3. *To treat the second head:* Using the fingers and thumbs, pick up and compress the fibers. Apply slow, deep compression in 1-inch segments, moving distally until reaching the acromion process. (See Figure 9.52.)
4. Hook the fingers under the anterior fibers of the trapezius; keep the thumb stationary, and uncurl the trapezius muscle while keeping the palm facing upward. (See Figure 9.53.)
5. *To treat the third head:* Relieve tautness by placing the client's arm at the side of the body with a small bolster underneath the head of the humerus, thereby shortening the muscle. Using the fingers and thumbs, pick up and compress the muscle fibers from the spine of the scapula to T1 through T4. Apply slow, deep friction, moving in 1-inch segments distally until the acromion is reached. (See Figure 9.54.)



FIGURE 9.50

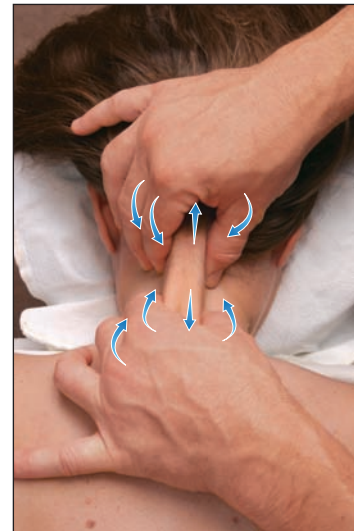


FIGURE 9.51

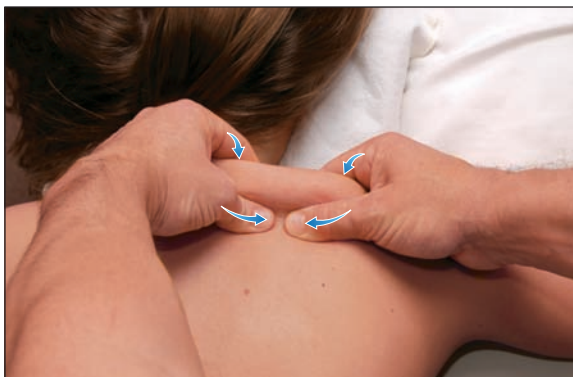


FIGURE 9.52

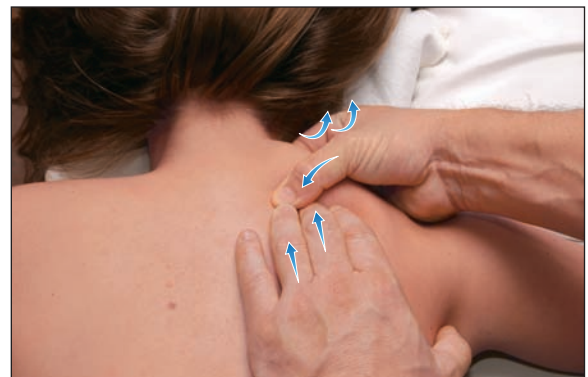


FIGURE 9.53

6. *To treat the fourth head:* Imagine a line between T12 and the acromion process of the scapula. Using the fingers and thumbs, pick up the fibers along this diagonal path and treat with compression and friction, moving in 1-inch segments. (See Figure 9.55.)
7. Using the thumbs, treat the entire upper thoracic region with compression and slow, precise friction. Maintain the client's edge to ensure client's comfort. Remember, no pain means more gain. (See Figure 9.56.)
8. Using the fingertips, treat the myofascial divisions of the trapezius from the spine, moving laterally toward their distal attachments. The use of the elbow is extremely effective and recommended. Use caution, focus and control when applying and treating with the elbow. Start light and only proceed deeper when client communicates deeper. (See Figures 9.57.)

Sit at the head of the table, facing the client's head.

9. Using the thumbs, treat the distal one-third clavicular attachment with compression. Apply static compression into the lateral muscle fibers. Penetrate slowly and deeply, moving laterally as far as possible. This will ensure a thorough treatment to these often-forgotten areas. (See Figure 9.58.)

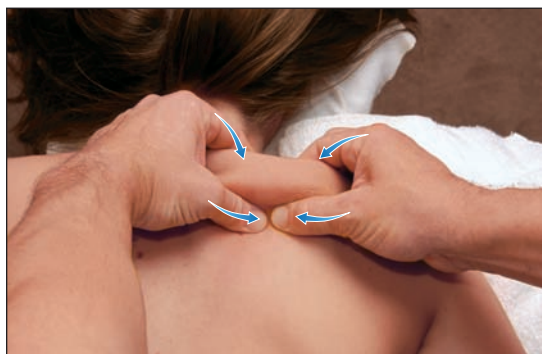


FIGURE 9.54

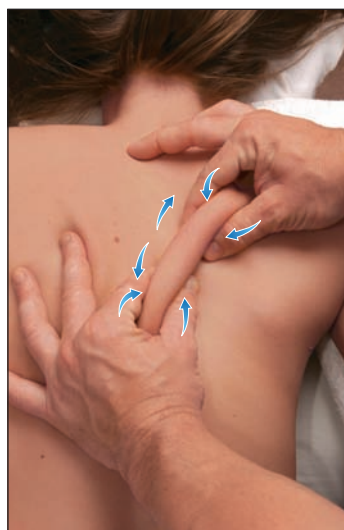


FIGURE 9.55



FIGURE 9.56

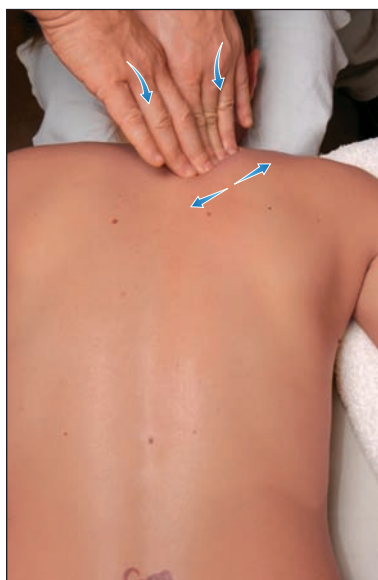


FIGURE 9.57a



FIGURE 9.57b



FIGURE 9.58

RHOMBOIDS, FIGURES 9.59 AND 9.60

ORIGIN C7–T5 spinous processes

INSERTION Vertebral border of scapula, from root of spine to inferior angle

ACTION Retracts and stabilizes scapula; elevates medial border of scapula; rotates scapula to assist in adduction of arm

MYOTOME C5

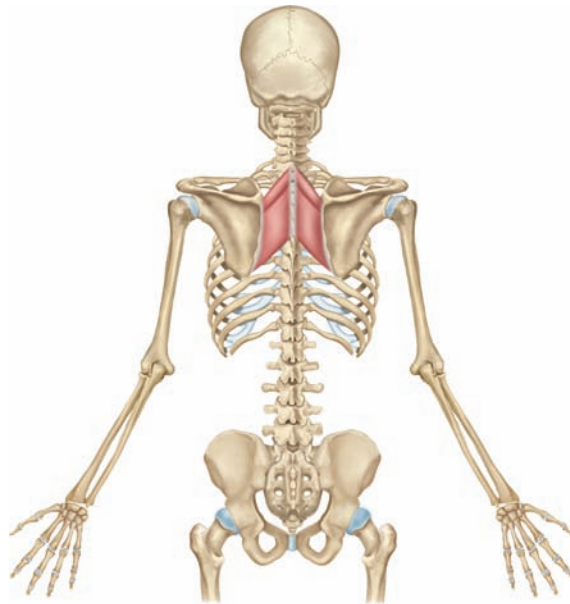


FIGURE 9.59 **Rhomboid Muscles**



FIGURE 9.60 **Rhomboid Muscles and Referred Pain Pattern**

CLINICAL NOTES: Rhomboids

The rhomboid muscle group consists of the larger rhomboidius major and the smaller, superior rhomboidius minor. The rhomboids originate from the ligamentum nuchae and spinous processes of C7 through T5, traveling inferior at a 45-degree angle to the insertion on the vertebral border of the scapula.

All muscles that attach to the scapula directly control and stabilize glenohumeral movements and should be treated when there is pain or limited range of motion of the scapula and humerus. The primary function of the rhomboids is retraction (adduction) of the scapula with assistance from the second and third heads of the overlying trapezius muscle. The rhomboids also assist the latissimus dorsi in downward rotation of the scapula.

Chronic improper posture can create muscular imbalances and provoke pain. Increased tension levels and pain in this area are a common result of the latissimus dorsi, rhomboid and trapezius muscles' attempt to counteract anterior collapse of the torso.

ROUTINE: Rhomboids

Position of client: prone.

1. Using contoured hands and fingertips, treat the posterior torso muscles with slow, deep effleurage from the pelvis to the occiput. (See Figure 9.61.)
2. Using the thumbs or fingertips, treat the lamina groove between C7 and T5 with friction in 1-inch segments. (See Figure 9.62.)

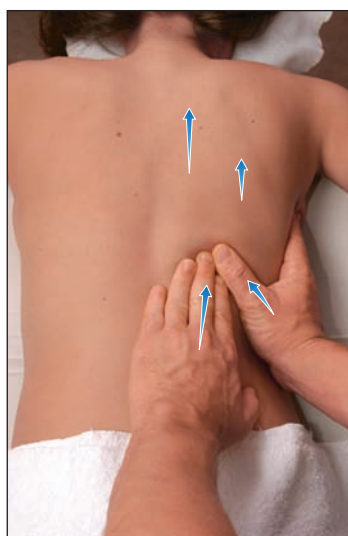


FIGURE 9.61



FIGURE 9.62

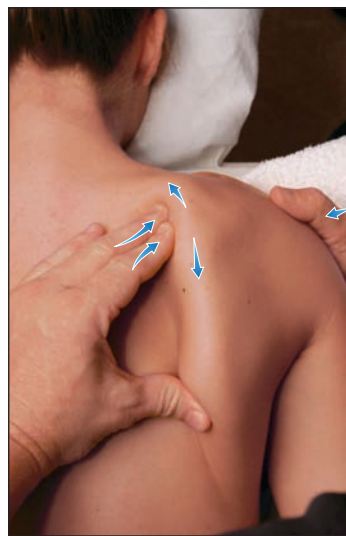


FIGURE 9.63

3. Place the client's arm in the small of the back, lifting the shoulder girdle up and off the rib cage to expose the vertebral border of the scapula. Using the fingertips, treat with compression and friction in 1-inch segments. Next, effleurage along the entire vertebral border, moving in a superior direction. (See Figure 9.63.)
4. Using the thumbs or fingertips, treat the entire rhomboids with cross-fiber friction.
5. Using the elbow, treat the upper thoracic region with slow, deeper pressure, utilizing the minimal-edge technique. (See Figure 9.64.)
6. Place the client's arm in the small of the back, lifting the shoulder girdle up and off the rib cage to expose the vertebral border of the scapula. Using the fingertips, treat the myofascial divisions of the rhomboids from the spine toward their attachments on the vertebral border of the scapula. (See Figure 9.65.)



FIGURE 9.64

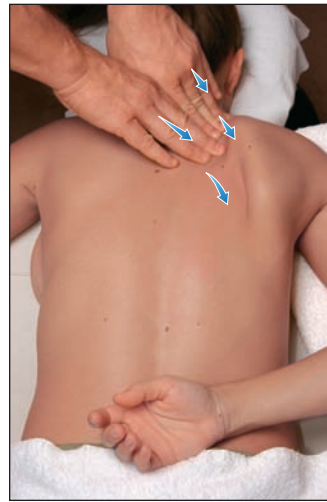


FIGURE 9.65

ROTATOR CUFF

SUPRASPINATUS, FIGURES 9.66 AND 9.67

ORIGIN	Supraspinous fossa of scapula
INSERTION	Greater tubercle of humerus
ACTION	Abduction of arm; stabilizes shoulder joint
MYOTOME	C5

INFRASPINATUS, FIGURES 9.66 AND 9.67

ORIGIN	Infraspinous fossa of scapula
INSERTION	Greater tubercle of humerus
ACTION	Laterally rotates arm; stabilizes shoulder joint
MYOTOME	C5, C6

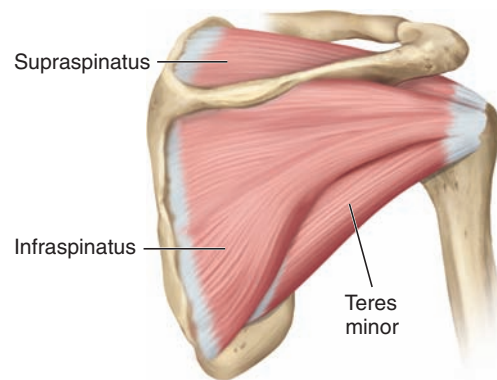


FIGURE 9.66 **Rotator Cuff—Supraspinatus, Infraspinatus, and Teres Minor Muscles**

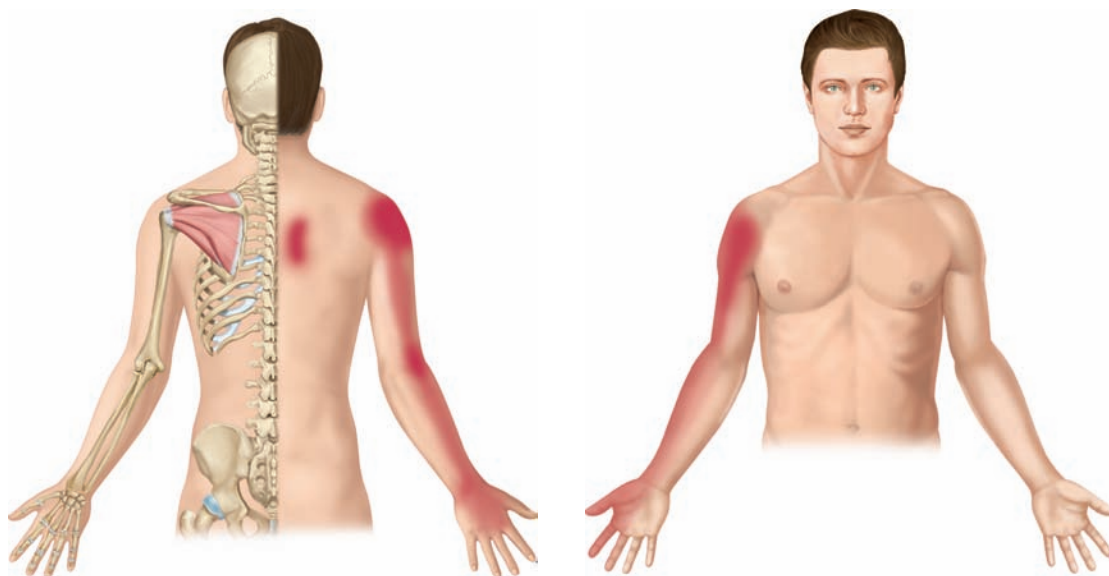


FIGURE 9.67 **Rotator Cuff—Supraspinatus, Infraspinatus, and Teres Minor Muscles and Referred Pain Patterns**

TERES MINOR, FIGURES 9.66 AND 9.67

ORIGIN	Upper axillary border of scapula
INSERTION	Greater tubercle of humerus
ACTION	Laterally rotates arm; stabilizes shoulder joint
MYOTOME	C5

CLINICAL NOTES: Rotator Cuff

Together, the supraspinatus, infraspinatus, teres minor, and subscapularis (discussed separately below) are known as the *rotator cuff* or *SITS muscles*.

The supraspinatus, infraspinatus, and teres minor originate on the scapula. The spine of the scapula is a very distinct bony landmark that is used as a reference point for these muscles. The supraspinatus is located superior to the spine of the scapula, whereas the infraspinatus lies inferior to the spine of the scapula. The teres minor lies just below the infraspinatus. These three muscles insert one below the other on the greater tubercle of the humerus.

The infraspinatus is the primary lateral rotator of the humerus. The teres minor assists in this function and should be assessed and treated with infraspinatus as a functional unit.

The supraspinatus, the middle deltoid, and the upper fibers of the trapezius are all synergists to one another in abduction at the shoulder joint. All should be treated when pain is present on movements that require abduction and elevation of the arm.

As a group, the rotator cuff muscles are stabilizers of the shoulder joint. Normal glenohumeral function depends on a balance of these muscles. A hypertonic supraspinatus could facilitate an upward displacement of the head of the humerus. The medial rotators and adductors of the humerus at the shoulder joint (teres major, pectoralis major, and subscapularis) are commonly responsible for anterior displacement of the humerus. These dysfunctions can disturb the synovial capsule of the shoulder joint. Pain and restrictions in range of motion can develop. If muscular imbalances in this area are left untreated, surgery may be recommended to address the symptoms. However, if the underlying cause, which is often muscular imbalance, is not addressed, the problem will not be fully resolved.

Sustained tractioning of the humerus (e.g., when carrying heavy objects) will cause the SITS muscles to become fatigued from the tension overload. Prolonged and repetitive movements can often entrap sensory nerves embedded in the muscle and may cause bursitis, tendonitis, and arthritis of the shoulder. A client may be diagnosed with a more complex problem: adhesive capsulitis or frozen shoulder.

Cervical disk pathology, thoracic outlet syndrome, and referred pain stemming from soft-tissue involvement around the brachial nerves can mimic rotator cuff syndromes. A strong indication of

supraspinatus and infraspinatus involvement is the inability of a client to put her hand in the small of the back.

If the client is a side-sleeper, suggest that she hug a pillow to help the shoulder muscles maintain a neutral position.

ROUTINE: Rotator Cuff

Position of client: prone.

1. Using the fingertips or thumbs, treat the supraspinatus muscle with static compression and slow parallel friction, moving in 1-inch segments. (See Figure 9.68.)
2. Using the fingertips or thumbs, treat the supraspinatus with slow, deep effleurage, moving medial to lateral until the acromion process is reached. (See Figure 9.69.)
3. Using the fingertips or thumbs, treat the infraspinatus with static compression and slow circular friction, moving in 1-inch segments. Treatment should start at the spine of the scapula and work medial to lateral, holding pressure at each contact point. Continue moving down a thumb width with each line of treatment until all the muscular fibers of the infraspinatus muscle are treated. (See Figure 9.70.)

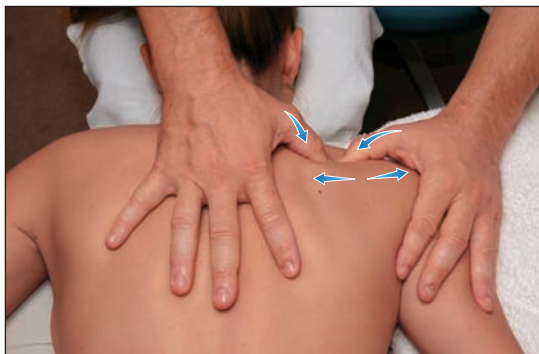


FIGURE 9.68

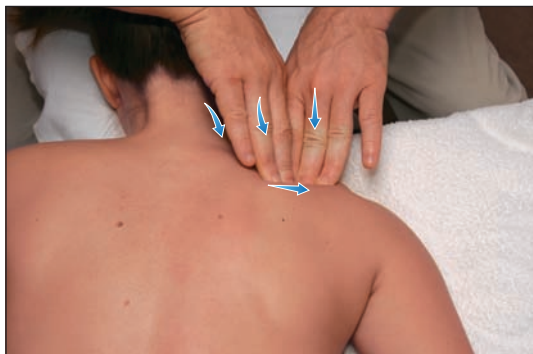


FIGURE 9.69



FIGURE 9.70

4. Using the fingertips or thumbs, treat the infraspinatus with slow, gliding effleurage from medial to lateral.
5. While simultaneously grasping and lifting the scapula, rotate the scapula upward and downward. Then continue with retraction and protraction. This series of mobilization techniques should be performed smoothly and rhythmically to ensure the client's comfort. (See Figure 9.71.)
6. Slide off the acromion process approximately 1 inch. All the rotator cuff tendons insert in this area. Using the thumbs, apply broad static compression to the "SIT" tendons, pressing through the fibers of the middle deltoid. (See Figure 9.72.)



FIGURE 9.71



FIGURE 9.72

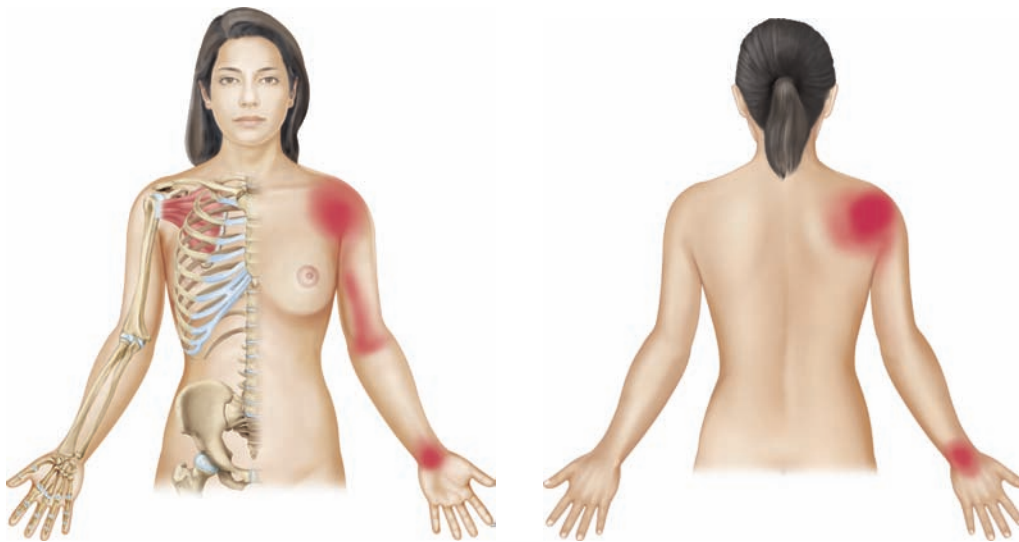
SUBSCAPULARIS, FIGURES 9.73 AND 9.74

ORIGIN Anterior surface of scapula (subscapular fossa)

INSERTION Lesser tubercle of humerus

ACTION Adduction and medial rotation of arm; stabilizes shoulder joint

MYOTOME C5, C6

FIGURE 9.73 **Subscapularis Muscles**FIGURE 9.74 **Subscapularis Muscle and Referred Pain Patterns**

CLINICAL NOTES: Subscapularis

The subscapularis originates on the anterior surface of the scapula and attaches at the most anterior point on the humerus, on the lesser tuberosity between the long and short heads of the biceps brachii. A large bursa that lies just underneath the tendon insertion links the humerus to the glenoid fossa of the scapula. This subacromial bursa has a direct pathologic relationship to the integrity of the synovial joint capsule of the shoulder.

The subscapularis is involved in almost every action of the humerus (medial rotation, flexion, extension, abduction, adduction). A hypertonic subscapularis may be marked with limited

range of motion and acute pain on abduction and external rotation of the arm at the shoulder joint.

Myofascial pain arising from trigger points in the subscapularis muscle can cause severe pain both at rest and in motion. The most common pain pattern is consolidated on the posterior shoulder with secondary referral trickling down the arm to a straplike pattern around the wrist. This may be misdiagnosed as carpal tunnel syndrome. The subscapularis is commonly involved with many painful conditions relating to glenohumeral restriction yet is the most overlooked.

ROUTINE: Subscapularis

Position of client: prone, with the client's arm alongside the body. Place your arm between the client's arm and body.

1. Cup one hand underneath the shoulder joint, and point your thumb pad into the anterior scapular fossa, lifting the scapula toward the ceiling. Grasp your other hand around the vertebral border of the scapula to assist in lifting the scapula up and onto the thumb. Coach the client in letting go of the weight of the shoulder blade, allowing it to drop onto your thumb and palm. With the weight of the scapula on your thumb and your thumb pointing upward, press toward the anterior scapula and hold static compression. It is important to release the pressure before moving to the next contact site; maintaining the client's minimal edge will allow the client to stay fully relaxed. (See Figure 9.75.)
2. While you lift the scapula up and off the rib cage, treat with a series of joint mobilizations including upward and downward rotations, protraction and retraction, and elevation and depression movements. (See Figure 9.76.)
3. Continue to lift and move the scapula with one hand. With the other hand, explore and treat the divisions of subscapularis with very slow, precise, and firm compression. (See Figure 9.77.)

Hang the client's arm off the table. If it's comfortable for the client, externally rotate the arm at the shoulder, stretching the subscapularis muscle and continue treatment.

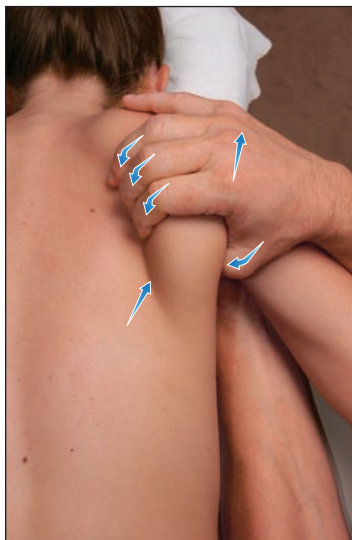


FIGURE 9.75

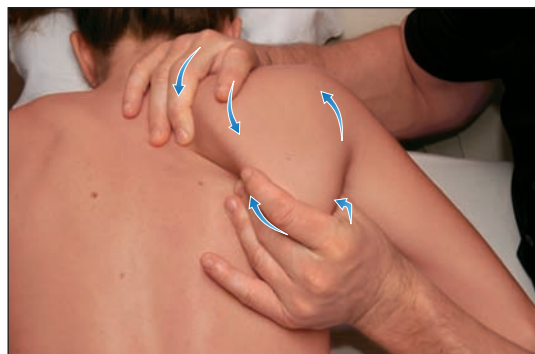


FIGURE 9.76



FIGURE 9.77

SPLenius CERVICIS, FIGURES 9.78 AND 9.79

ORIGIN Spinous processes of the thoracic vertebrae T3–T6

INSERTION Transverse process of C1 (atlas); posterior tubercles of C2–C3

ACTION Extends and rotates head to same side

MYOTOME C3

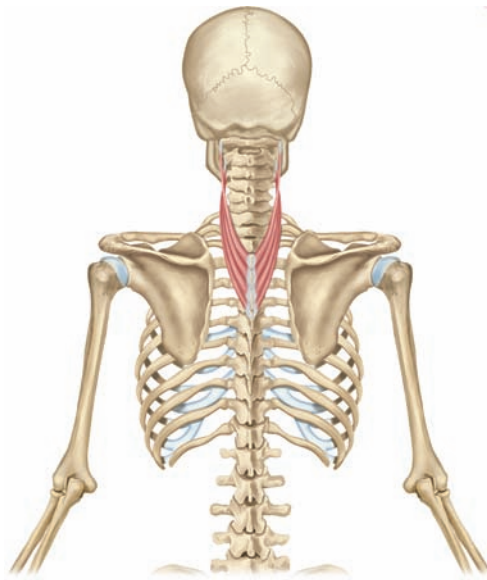


FIGURE 9.78 **Splenius Cervicis Muscle**

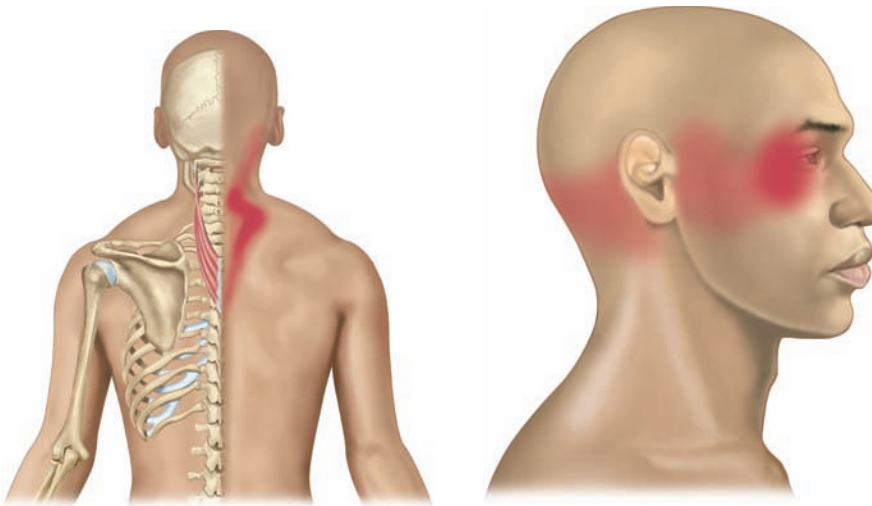


FIGURE 9.79 **Splenius Cervicis Muscle and Referred Pain Patterns**

SPLenius CAPITIS, FIGURES 9.80 AND 9.81

ORIGIN	Ligamentum nuchae, spinous processes of C7, T1–T3
INSERTION	Mastoid process of temporal bone
ACTION	Extends and rotates head to same side
MYOTOME	C7, T1–T3

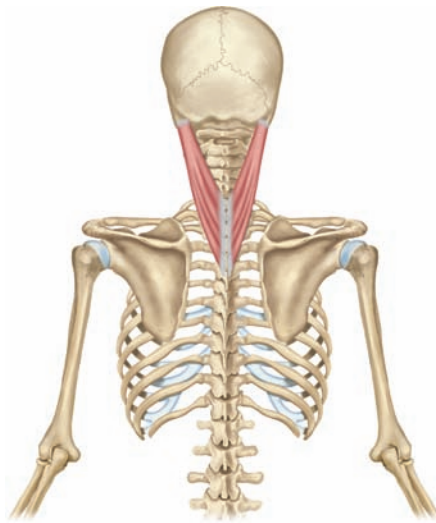


FIGURE 9.80 **Splenius Capitis Muscle**

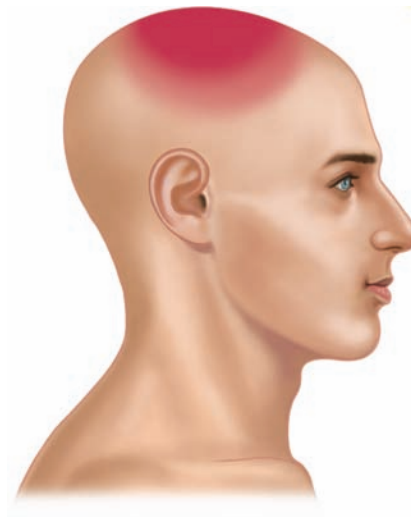


FIGURE 9.81 **Splenius Capitis Referred Pain Pattern**

CLINICAL NOTES: Splenius Cervicis and Capitis

The splenius cervicis and capitis muscles interweave with the ligamentum nuchae at the midline and originate below the spinous processes of T6 and upward to C3.

Above, splenius cervicis attaches to C2-C3 posterior tubercles and to the transverse process of C1 (atlas), whereas, the splenius capitis attaches to the mastoid process of the temporal bone.

The splenii muscles and the posterior cervical muscles should be treated as a continuous, functional unit. As a group, they are responsible for head and neck extension. Individually, the splenii muscles rotate the head and neck toward the side of contraction and are frequently involved with acute pain and restriction upon rotational movements of the neck and head, especially when loss of cervical curve is present. When loss of cervical curve and forward head positioning are present, this group will compensate and may become fatigued and painful. By restoring the cervical curve, you often eliminate the symptoms of fatigue and pain.

The splenius cervicis and levator scapulae share attachment sites and equally contribute to stiff-neck pain. The splenius capitis, suboccipitals, and SCM have attachment sites in close proximity to one another and equally contribute to pain that refers upward, causing headaches.

Sustained forward head positioning, whiplash injuries, poor postural habits, inadequate neck support while sleeping, and muscular imbalances from other parts of the body can cause strain, pain, and limited range of motion in the neck.

ROUTINE: Splenius Cervicis and Capitis

Position of client: prone. Put the face rest in a position that will flex the neck and allow the client's chin to be closer to the chest. This will expose the posterior cervical muscles and the lamina groove. (See Figure 9.82.)

Prior to treating the cervical muscles, treat the compartment distortions below from the originating sources, which lead up to and affect the muscles of the neck.

1. Using the fingertips, treat with specific compression to the splenii muscles. Continue with specific parallel friction, moving in 1-inch segments between T6 and the occiput. (See Figure 9.83.)



FIGURE 9.82



FIGURE 9.83

2. Using the thumbs, treat the bellies of the splenii along the spinous processes where they originate on the upper thoracic vertebra. Apply static compression into the splenii muscles at a 45-degree angle at each contact site.
3. Using both thumbs, apply slow, deep effleurage from C7 to the occiput three lines (medial, median, and lateral). Identify and treat hypersensitive tissues with static compression. (See Figure 9.84.)

Have your client move to a supine position. Sit at the head of the table with one hand lightly placed on the client's forehead. Use the other hand to cup underneath the neck with the thumb at the base of the occipital ridge, directly between the spinous processes of the cervical spine and the posterior tubercles. Keep your elbows close to your body, and maintain correct posture.

4. Using the thumb, apply slow, deep effleurage down the lamina groove while maintaining pressure toward the ceiling. If this is performed properly, the client's head and neck should extend back with each stroke. (See Figure 9.85.)
5. Continue treating the lamina groove while rotating the client's head away from the side you are treating. (See Figure 9.86.) Continue treating the lamina groove while rotating the head back to the neutral position. (See Figure 9.87.) This is a continuous series of effleurage strokes and should be performed smoothly and rhythmically.
6. Move your hand from the client's forehead to under the head to provide support. Cup the other hand underneath the lower cervicals, and place your thumb to the right of the spine and anterior to the trapezius muscle. (See Figure 9.88.)
7. Rotate the client's head toward the side you are treating. Using the thumb, apply pressure at a 45-degree angle toward the spine. Be sure to stay anterior to the trapezius and posterior to the transverse processes. A small groove will appear. This will allow you to penetrate deep into the bellies of the splenius cervicis and capitis. Compress and hold, utilizing the minimal-edge technique; then withdraw the thumb straight out while rotating the head back to a neutral position. (See Figure 9.89.)

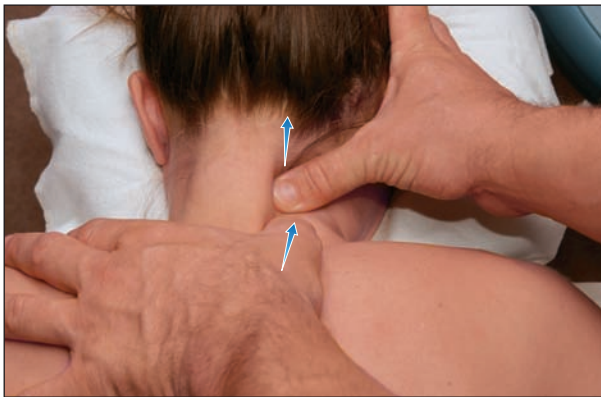


FIGURE 9.84



FIGURE 9.85



FIGURE 9.86

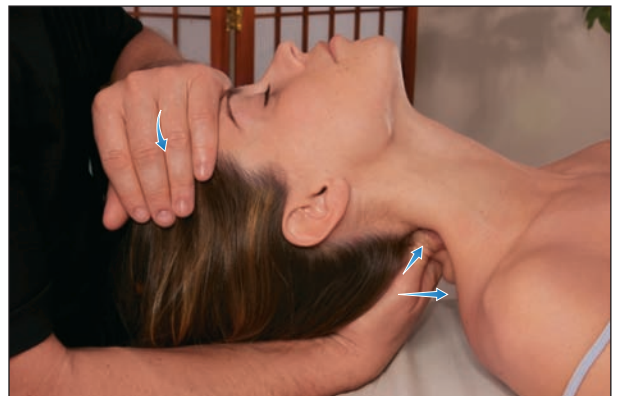


FIGURE 9.87

8. Repeat the previous step, moving in 1-inch segments along the lamina groove. Rotate the head back to a neutral position after each segment before reentering the lamina groove.
9. Repeat steps 1 through 7 on the opposite side, using the opposite hands.



FIGURE 9.88



FIGURE 9.89

LEVATOR SCAPULAE, FIGURES 9.90 AND 9.91

ORIGIN C1 transverse process, C2–C4 posterior tubercles

INSERTION Superior angle to root of spine of scapula

ACTION Elevates medial border of scapula; downwardly rotates scapula; rotates head to same side

MYOTOME C5

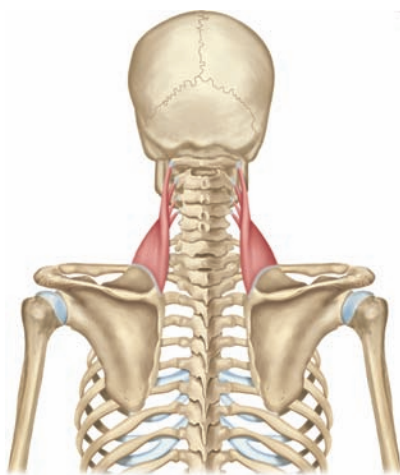
FIGURE 9.90 **Levator Scapulae Muscles**



FIGURE 9.91 **Levator Scapulae Muscle and Referred Pain Pattern**

CLINICAL NOTES: Levator Scapulae

The levator scapulae originates on C1 through C4, spirals inferiorly, and inserts on the superior angle of the scapula. The levator scapulae is one of the most commonly involved muscles when pain throughout the angle of the neck and shoulder is present. This is common with an elevated shoulder girdle that causes one side of the cervical muscles to be shorter than its neighboring muscles on the opposite, longer side. This imbalance can accumulate locally, such as from holding a telephone receiver to the ear for an extended period of time, or can result from a shortening reaction to postural imbalances that originate below.

The levator scapulae, splenius cervicis, and suboccipitals have attachment sites on the atlas. Since approximately 50 percent of cervical rotation occurs at the atlantoaxial joint, these muscles play an important role in cervical extension and rotation. If limited range of motion is noted, examination and treatment of this group would be indicated. Trigger points may also form in the splenii and scalene muscle groups, as they share common attachments on the posterior tubercles of the cervical spine and can facilitate intrajoint pressure.

A person with poor postural patterns is likely to suffer from a chronic stiff neck. The levator scapulae can easily be overloaded if the head is rotated to one side or laterally flexed for an extended period of time.

ROUTINE: Levator Scapulae

Position of client: prone.

Treat the trapezius muscle first. The upper fibers of the trapezius lie directly over the levator scapulae.

1. Using thumbs and fingers, pick up and compress the upper fibers of the trapezius. Continue compression at each contact point. (See Figure 9.92.)

2. Displace the second head of the trapezius medially. Using the fingertips, treat the levator scapulae with slow, deep compression and effleurage. (See Figure 9.93.)

With one hand, place the client's arm on the small of their back, while lifting and supporting the client's shoulder girdle from underneath. Using the fingertips of the other hand, examine the levator scapulae with cross-fiber friction (See Figure 9.94.)

3. Using the fingertips or thumbs, with both hands press through the trapezius muscle and treat the muscle belly of the levator scapulae just above the superior angle of the scapula with static compression and slow rhythmic friction. Move in 1-inch segments throughout the length of the muscle. (See Figure 9.95.)
4. Using the fingertips and thumb, glide in opposite directions with specific slow, deep effleurage, treating toward the superior angle of the scapula and up to the posterior tubercles and the C1 transverse process of the atlas. (See Figure 9.96.)
5. Using the fingertips, treat the muscle belly of the levator scapulae with specific, static compression at each contact site. Then finish with gliding effleurage, traveling the length of the muscle and isolating the attachments on the cervical vertebrae. (See Figure 9.97.)



FIGURE 9.92

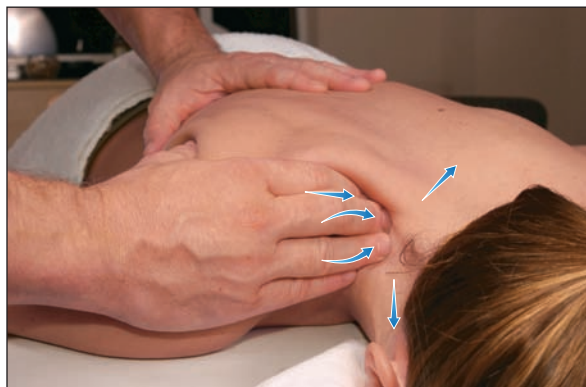


FIGURE 9.93



FIGURE 9.94

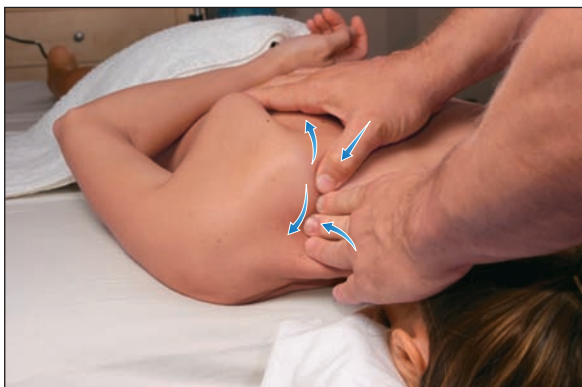


FIGURE 9.95



FIGURE 9.96

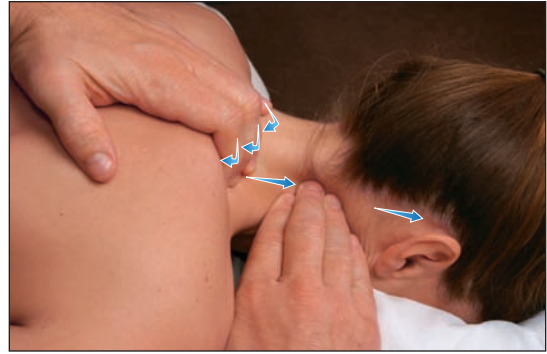


FIGURE 9.97

POSTERIOR SUBOCCIPITALS

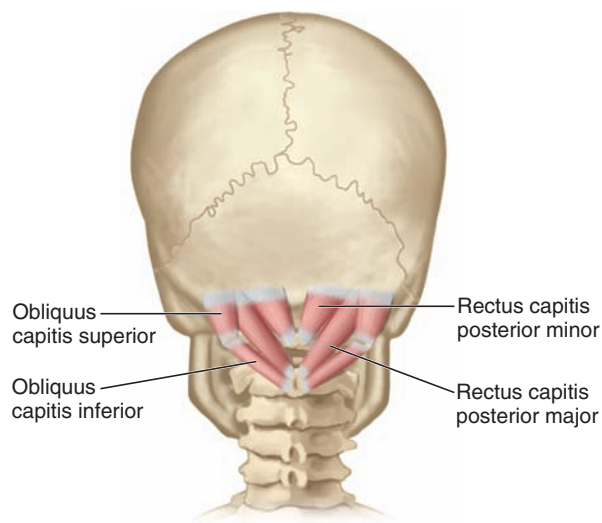
OBLIQUUS CAPITIS SUPERIOR, FIGURES 9.98 AND 9.99

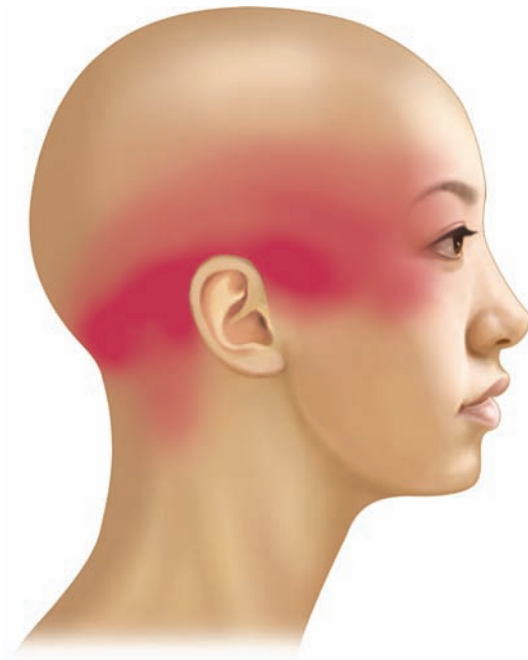
ORIGIN Transverse process of atlas

INSERTION Lateral base of occiput

ACTION Extends and flexes (tilts) head laterally

MYOTOME Occipital nerve

FIGURE 9.98 **Posterior Suboccipitals Muscles**

OBLIQUUS CAPITIS INFERIOR, FIGURES 9.98 AND 9.99**ORIGIN** Spinous process of axis**INSERTION** Transverse process of atlas**ACTION** Rotates head to same side**MYOTOME** Occipital nerve**RECTUS CAPITIS POSTERIOR MAJOR,** FIGURES 9.98 AND 9.99**ORIGIN** Spinous process of axis**INSERTION** Lateral base of occiput**ACTION** Extends and rotates head to same side**MYOTOME** Occipital nerveFIGURE 9.99 **Posterior Suboccipitals Referred Pain Pattern**

RECTUS CAPITIS POSTERIOR MINOR, FIGURES 9.98 AND 9.99

ORIGIN	Posterior tubercle of atlas
INSERTION	Nuchal/midline of occiput
ACTION	Extends head
MYOTOME	Occipital nerve

CLINICAL NOTES: Posterior Suboccipitals

The two superior articulations of the spinal column are highly specialized joints that provide a significant amount of head mobility. At the atlanto-occipital joint, the obliquus capitis superior and rectus capitis posterior minor cause the head to tilt and/or rock (laterally flex and extend) on the contracted side. The muscle fibers of the obliquus capitis inferior and the rectus capitis posterior major have attachments on the occiput, atlas, and axis. When these muscles contract, the head rotates toward the contracted side. Bilateral contraction of all the posterior suboccipitals causes a compression of the occipital base onto the upper cervical vertebrae.

The posterior suboccipitals (excluding the rectus capitis posterior minor) bilaterally form the suboccipital triangles that enclose the transverse loop of the vertebral artery.

The most common trigger point referral of the suboccipital muscles travels laterally and superiorly into the head behind the eye. The lateral and superior referrals can feel like a viselike headache, which can encompass the perimeter of the head. Headache pain and limited cervical movement are a strong indication for examination and treatment of the posterior suboccipital muscles.

A client with forward head positioning would benefit from treatment of the posterior suboccipital muscles. This muscle group attempts to compensate for the downward, collapsed stooped posture and becomes increasingly more tense as the head increasingly moves forward. This is primarily due to an innate physiologic adaptation in which the body always tries to maintain the eyes level to the horizon and the head over the base of the sacrum. The suboccipital muscles compress, as this is the body's last-ditch effort to normalize posture.

The shortening of the posterior suboccipital muscles can result directly from a whiplash injury or indirectly from muscles shortening elsewhere below or on the opposite side of the body. Postural distortion such as scoliosis can lead to chronic shortening of one or both sides of the occipital muscles. The suboccipital muscles play an important role in cervical mobility, stability, and perpetuation of headaches. Clinical massage therapy is an important supplement to a treatment plan, including spinal manipulations.

ROUTINE: Posterior Suboccipitals

Position of client: supine. Make sure the client's head is properly aligned. Place your fingertips under the occipital ridge, between the ridge and the first cervical vertebra. Then coach the client on letting go, allowing the head to rest on your flexed fingertips.

1. With flexed fingertips and the client relaxed, apply static compression to the suboccipital muscles. Next, explore and treat the suboccipital muscles bilaterally (hands moving in opposite directions) from the midline of the body to the mastoid processes with slow, precise circular friction, moving in 1-inch segments. (See Figure 9.100.)

Stand at the client's shoulder. Rotate the client's head away from you. Place one hand underneath the client's neck and the other hand on the client's forehead to provide support.

2. Using the thumb, treat the occipital ridge from the mastoid process to the midline with compression and friction in both directions. Friction should be performed slowly and rhythmically to ensure the client's comfort.
3. Treat the suboccipitals between C1 and the occipital ridge with compression and friction.
4. Treat the suboccipitals between C1 and C2 with compression and friction. (See Figure 9.101.)

Position of client: prone. Put the face rest in a position that will flex the neck and allow the client's chin to be closer to the chest. This will expose the occipital muscles and the posterior cervical muscles. (See Figure 9.102.)

5. Using the fingertips or thumbs, treat the occipital ridge with compression and friction in 1-inch segments. Friction should be performed slowly and rhythmically to ensure client comfort.
6. Using the fingertips or thumbs, treat the suboccipitals between C1 and the occipital ridge with compression and friction in 1-inch segments.
7. Using the fingertips or thumbs, treat the suboccipitals between C1 and C2 with compression and friction in 1-inch segments. Effleurage the posterior cervicals, tracing 3 lines (medial, median and lateral). (See Figure 9.103.)

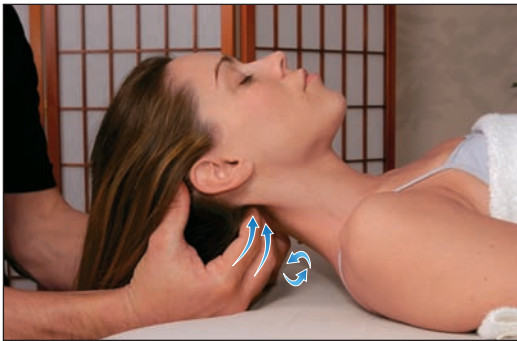


FIGURE 9.100

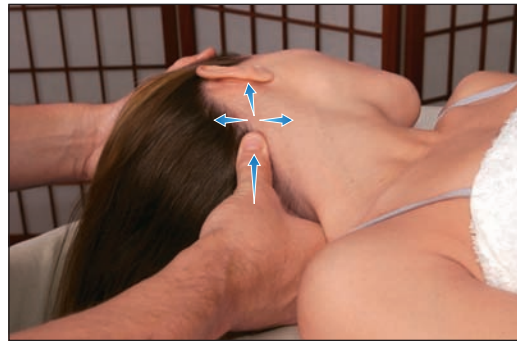


FIGURE 9.101



FIGURE 9.102

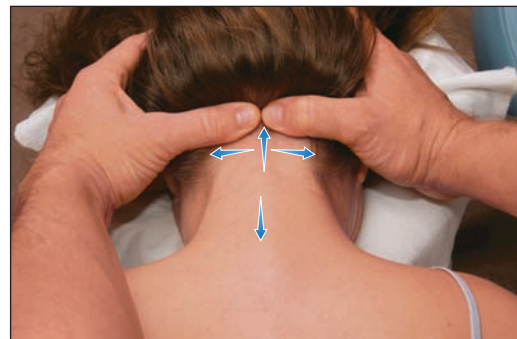


FIGURE 9.103

OCCIPITALIS, FIGURES 9.104 AND 9.105

ORIGIN 1 inch above the occipital ridge

INSERTION Galea aponeurotica/epicranial aponeurosis

ACTION Assists expression of face, eyes, and forehead

MYOTOME Facial nerve

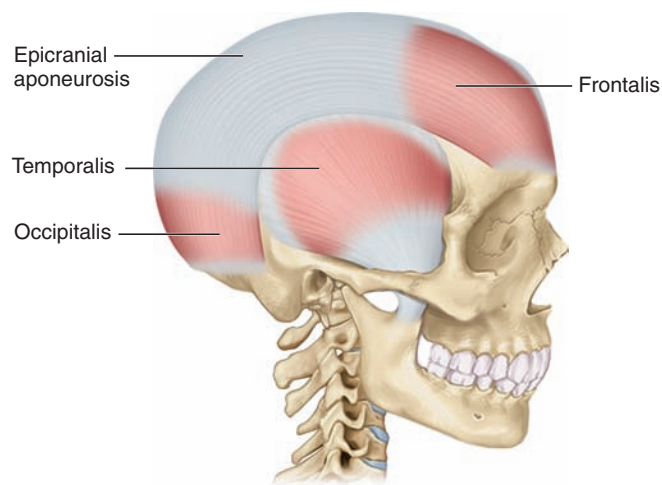


FIGURE 9.104 **Occipitalis Muscle**

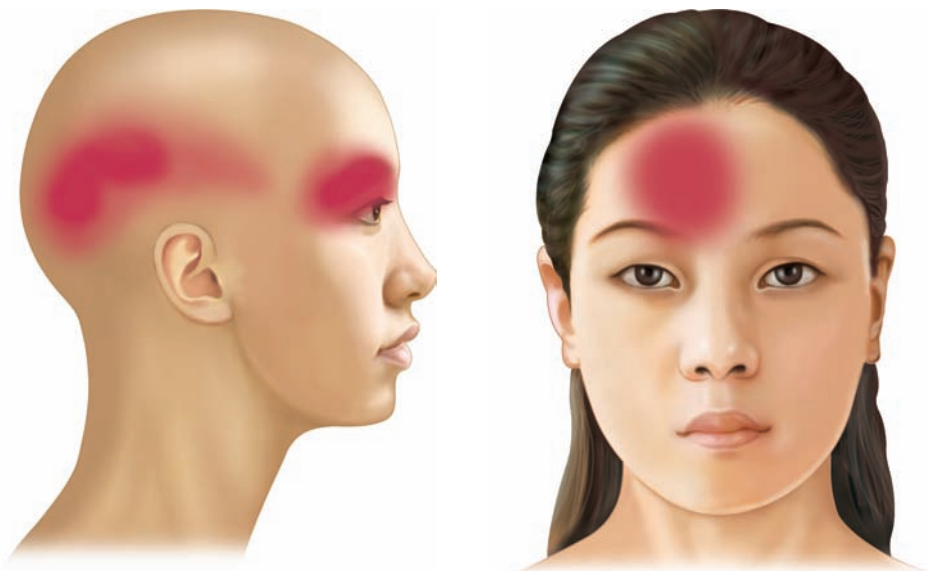


FIGURE 9.105 **Occipitalis Referred Pain Patterns**

CLINICAL NOTES: Occipitalis

The occipitalis can refer intense pain throughout the posterior scalp, forehead and eye socket. The occipitalis muscle should be treated when headaches are persistent throughout the scalp and region of the eye.

ROUTINE: Occipitalis

Position of client: prone.

1. Move 1 inch lateral to the occipital protuberance at the midline. Using contoured fingertips, treat both sides with circular friction. (See Figure 9.106.)

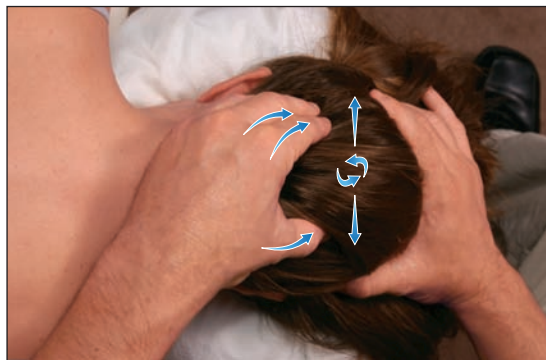


FIGURE 9.106

STRETCHING

The client interlocks hands behind the head and gently pulls the head down, bringing the chin to the chest.

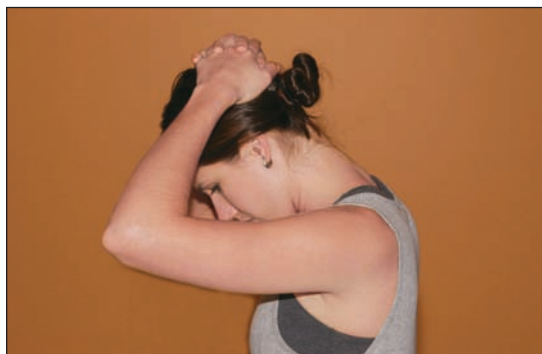


FIGURE 9.107 Posterior cervical stretch

While sitting, the client interlocks hands behind the head, bends at the waistline, and gently pulls the head toward the floor.



FIGURE 9.108 Upper posterior torso stretch

While the client is seated and with a pillow placed in the abdomen for support and comfort, allow the client to freely bend forward to her comfort level while dangling the arms between the legs. While supporting the sacrum with your lower hand, gently place your upper hand on the client's upper thoracic spine. Assist the client by slowly pushing down on the thoracic spine while maintaining communication to ensure the client's comfort level.

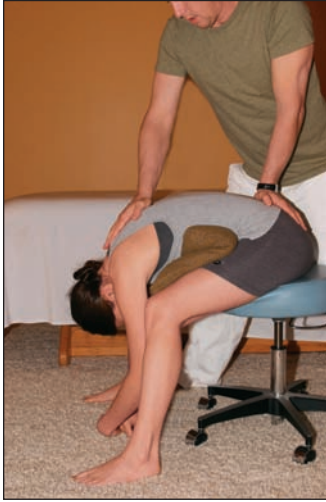


FIGURE 9.109 Assisted posterior torso stretch

While the client is lying on the back, allow the client to comfortably rotate the spine, allowing the leg to dangle off the table. Assist the rotational stretch by stabilizing the upper shoulder girdle with one hand while placing the other hand across the posterior pelvis, moving the pelvis toward the side of the table and furthering the stretch.



FIGURE 9.110 Assisted posterior torso stretch (seated position)

Have the client curl up and bring the knees to the chest. Assist the client's stretch by placing your palm and forearm under the low back and sacrum, gently stretching the myofascia, while placing your other hand across the legs for stabilizing and maintaining proper alignment.

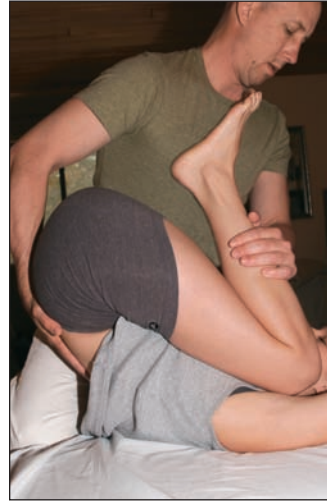


FIGURE 9.111 Assisted posterior torso stretch (supine curled position)

While the client is lying on the back, allow the client to comfortably rotate the spine, allowing the leg to dangle off the table. Assist the rotational stretch by stabilizing the upper shoulder girdle with one hand while placing the other hand across the posterior pelvis, moving the pelvis toward the side of the table and furthering the stretch.

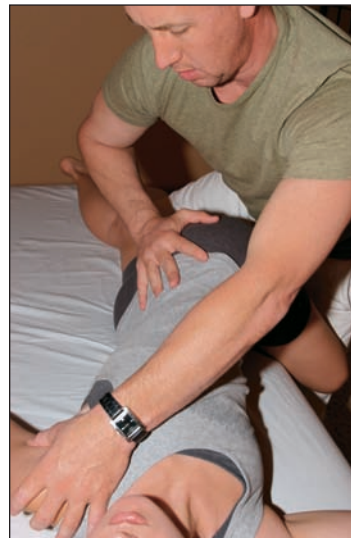


FIGURE 9.112 Assisted rotational torso stretch

Have the client lie prone with an arm hanging off the table. With one hand, grasp the client's shoulder for support while your forearm anchors the scapula and your other hand grasps the client's forearm. Keep the elbow flexed at a 90-degree angle, and lift the forearm toward you, stretching the lateral rotators.



FIGURE 9.113 Assisted lateral rotator stretch

Have the client lie prone with an arm hanging off the table. With one hand, grasp the client's shoulder for support while your forearm anchors the scapula and your other hand grasps the client's forearm. Keep the elbow flexed at a 90-degree angle, and lift the forearm away from you to stretch the medial rotators.



FIGURE 9.114 Assisted medial rotator stretch

BRIEF SUMMARY

The posterior torso compartment (PTC) is a chain of connecting muscles and fascia that arise from the sacrum, ilium, vertebral column, rib cage, and scapula; it travels up to the occipital ridge and mastoid process of the skull. It is a pulley system of muscles that attaches the back of the pelvis to the head. Postural distortions on all planes arise from muscular imbalances and affect many joints, including the sacroiliac and spinal facets. Postural distortions also contribute to the forward and downward collapsing of the rib cage, scapulae restrictions, tilted shoulder girdles, and persistent neck conditions from whiplash injury and for sustaining proper posture. The extensors of the lumbar and cervical spine and the retractor muscles of the scapulae often are tighter, produce the most trigger points, and elicit the most pain. It is these posterior compartment muscles that countertighten and resist the forward and downward pulls of tension from the shortened trunk flexors and hip extensors. Treatment to the PTC is delivered in sequence, with treatments starting at the sacrum, lumbar and thoracic rib cage, vertebral column, scapulae, shoulders, and neck.

The Clinical Notes boxes in this chapter cover muscular imbalances that affect posture and pain. The Routine boxes and their illustrations provide guidance for proper hand placement in delivering effective therapy techniques. The Stretching box demonstrates specific stretching techniques that are safe, effective, and easy to do.

REVIEW QUESTIONS

1. Name the two deep paraspinal muscles lying within the lamina groove that extend, rotate, and stabilize the facet joints of the spinal column.

2. Name the three muscular divisions of the quadratus lumborum.

3. What is the only muscle that has attachment sites on the pelvis, spine, and upper extremity?

4. What is the primary function of the rhomboids?

5. Name the four rotator cuff muscles known as the *SITS* muscles.

6. A hypertonic subscapularis muscle may be marked with limited range of motion and acute pain on what two movements of the arm at the shoulder joint?

7. Name the muscle group that tilts and rocks the head at the level of C1 and C2 and that causes referral headaches.

8. Name the muscle that, when shortened, will pull the ilium into abnormal elevation, subsequently causing functional scoliosis and a deviation in leg lengths.

9. Muscles attaching to the sacrum are anchored by a thickened layer of fascia. What is this layer of fascia called?

10. Name the superficial muscle of the thoracic and cervical region that fans out and attaches to the spine, occiput, and distal end of the clavicle.

CRITICAL-THINKING QUESTIONS

The client complains of unilateral pain in the left lumbar region, specifically on the iliac crest with spillover pain into the back-pocket region of the buttock.

1. What muscle connecting to the lumbar spine could elevate the hip, subsequently causing a short leg and facilitating a functional scoliosis?
2. What muscles lying deep in the lamina groove have the ability to compress the spinal facet joints and restrict rotational movements of the trunk?



CHAPTER 10
UPPER-EXTREMITY COMPARTMENT
(UEC)

LEARNING OUTCOMES

After completing this chapter, you will be able to:

- 10.1 List and identify the muscles of the UEC.
- 10.2 Define the origins and insertions of the muscles of the UEC.
- 10.3 Describe the actions of the UEC.
- 10.4 Recognize the pain patterns of the UEC.
- 10.5 Discuss the clinical notes for and the importance of treating the muscles of the UEC.
- 10.6 Demonstrate the client positioning and treatment routines of the UEC.
- 10.7 Demonstrate safe and effective stretching techniques for the muscles of the UEC.

OVERVIEW

Identifying and isolating muscles causing restriction, pain, and weakness of the arm, elbow, and forearm can be challenging. A massage/bodywork student who diligently practices muscle identification and palpatory skills will have a head start in treating chronic muscle tension and restrictions that cause pain.

The upper-extremity compartment (UEC) includes muscles of the arm, forearm and hand that are frequently involved in painful conditions that affect the joints of the shoulder, elbow, and wrist. Distinguishing the difference between local and referral pain that manifests, for example, in the elbow and wrist can be challenging. Many distant muscles located higher up in the neck, chest, and shoulder harbor trigger points having direct pain referrals into the upper extremity. Pain referrals may be caused by cervical nerve root compression (cervical disk migrating into a nerve root) or a muscle or a group of muscles sustaining chronic excess muscle and nerve tension (CEM&NT) entrapping or otherwise irritating sensory nerves. When formulating a treatment plan, a therapist should examine muscles higher up in conjunction with local muscles where pain is actually experienced. For instance, the subscapularis muscle (PTC) can produce referral symptoms down the arm to the wrist. The rotator cuff muscles can refer pain below the shoulder and to the elbow. The scalene muscles (ATC) have the ability to entrap the brachial plexus in the neck, producing symptoms anywhere from the shoulder down to the wrist and hand, producing pain and/or weakness.

When UEC symptoms exist, it is important to rule out nerve compression from bulging cervical disks and soft-tissue nerve entrapment producing trigger point referrals from muscles higher up the arm and shoulder.

Painful and weak hand grips are symptoms potentially caused by excessive muscle tension and trigger points in the brachioradialis and the extensor muscles of the forearm. Chronic excess muscle tension causes tennis elbow, a common medical diagnosis given when localized pain of the elbow is present.

The prime flexor muscle of the elbow, known as the *brachialis*, is overshadowed by the biceps brachii muscle and frequently involved with elbow pain sustained by repetitive motion, muscular overload, and poor ergonomics at the workplace.

CLINICAL SUCCESS

A client presented with a gradual onset of pain in his right elbow and forearm and a painful and weak grip. The therapist examined the extensor muscles of his forearm and found them to be hypersensitive; the client experienced pain with slow, deep effleurage. The area of hypersensitivity was at the lateral epicondyle of the humerus, which is typical of tennis elbow. The client stated that the pain was recent and might have been caused by chopping firewood and performing heavy yard work 2 weeks before its onset. The client had difficulty grasping objects; his grip was weak, and his forearm muscles were painful upon movement.

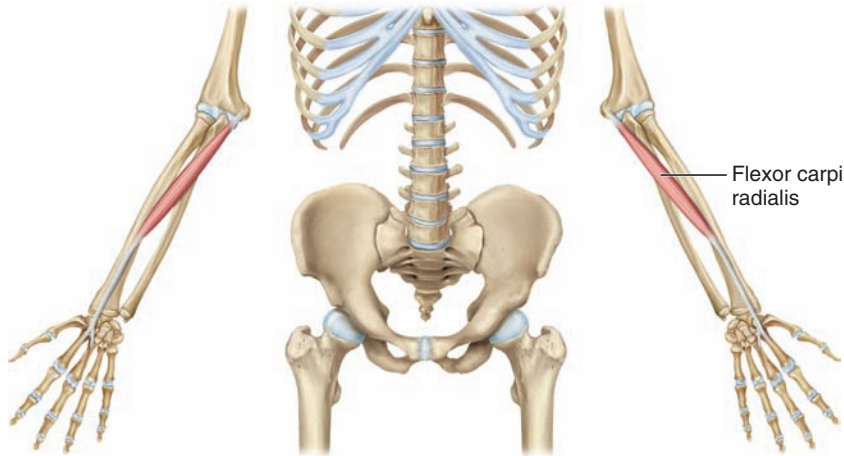
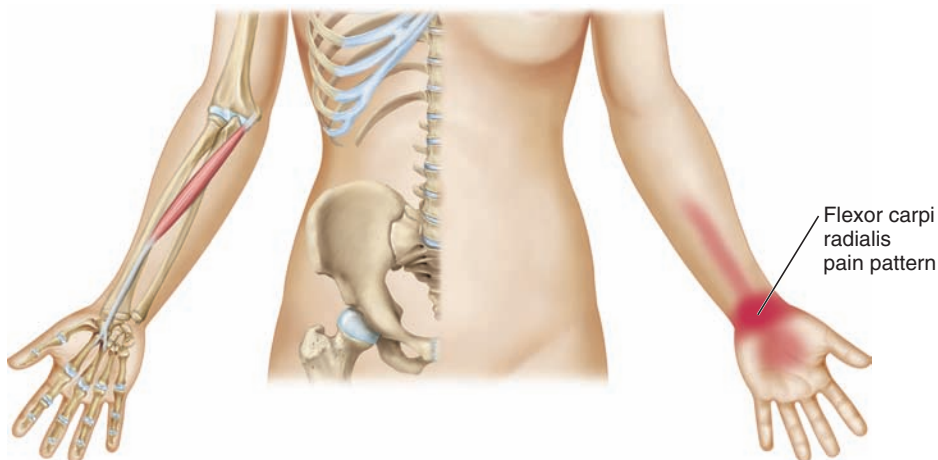
The therapist's first objective was to release the muscles that flexed the elbow. The client was placed in the supine position with the arm flexed at a 90-degree angle and resting on the therapist's chest. The brachialis muscle (prime flexor) was isolated by penetrating deep into and underneath the biceps brachii muscle. Using four-fingertip compressions to broaden the contact, the therapist explored and treated the entire brachialis muscle while slowly straightening and flexing the elbow and taking care not to cause discomfort to the client. Next, the biceps brachii muscle was isolated and treated. Each head was separated from top to bottom, with more time spent toward the insertion site at the crease of the elbow. It was important to treat the brachialis first to restore fluid flexion and extension movements of the elbow. This also helped decrease restriction and pain on full extension.

Next, the brachioradialis muscle was isolated because it was believed to be the source of the painful and weak grip. Pickup compression was utilized while moving in 1-inch segments and holding each compression firmly. This elicited a trigger point response down the forearm and into the wrist. Chronic excessive muscle tension and soreness was noted at each palpable segment of the muscle, with trigger point pain referring to the web of the thumb and the styloid process of the distal radius. The wrist and hand extensors originating from the forearm were treated with slow, deep compression; they were tender on palpation. Treatment was administered in a precise manner throughout each muscle belly, division, and septa with slow finger-point effleurage.

After completing the session, the client experienced a significant reduction of pain upon movement. Extension of his arm was less restricted and the grip strength restored. The client was instructed to perform self-massage and stretching techniques on a daily basis to help restore proper functioning to the muscles.

FLEXORS OF THE WRIST, HAND, AND FINGERS**FLEXOR CARPI RADIALIS,** FIGURES 10.1 AND 10.2

ORIGIN	Medial epicondyle of humerus
INSERTION	Proximal end of 2nd and 3rd metacarpals
ACTION	Flexes and radially abducts hand at wrist
MYOTOME	C6, C7

FIGURE 10.1 **Flexor Carpi Radialis Muscles**FIGURE 10.2 **Flexor Carpi Radialis Muscle and Referred Pain Pattern**

FLEXOR CARPI ULNARIS, FIGURES 10.3 AND 10.4

ORIGIN Medial epicondyle of humerus, olecranon process of ulna

INSERTION Pisiform, hamate, and base of 5th metacarpal

ACTION Flexes and adducts hand at wrist

MYOTOME C8, T1

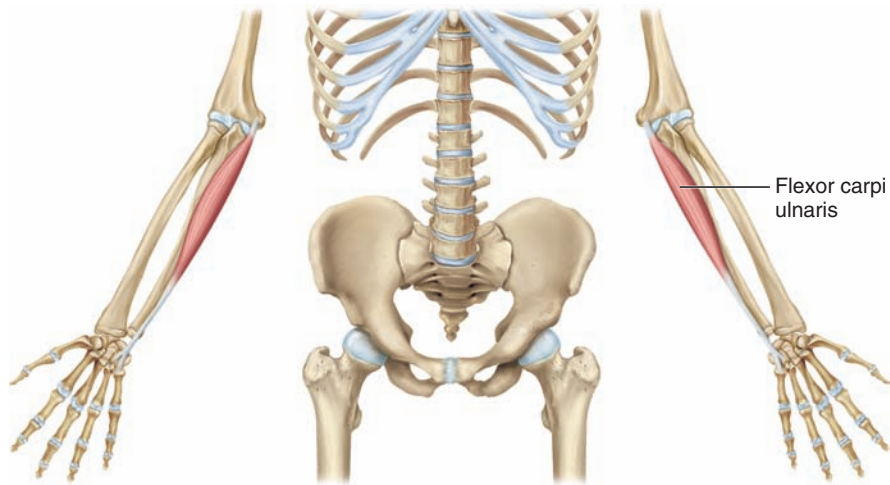


FIGURE 10.3 **Flexor Carpi Ulnaris Muscles**

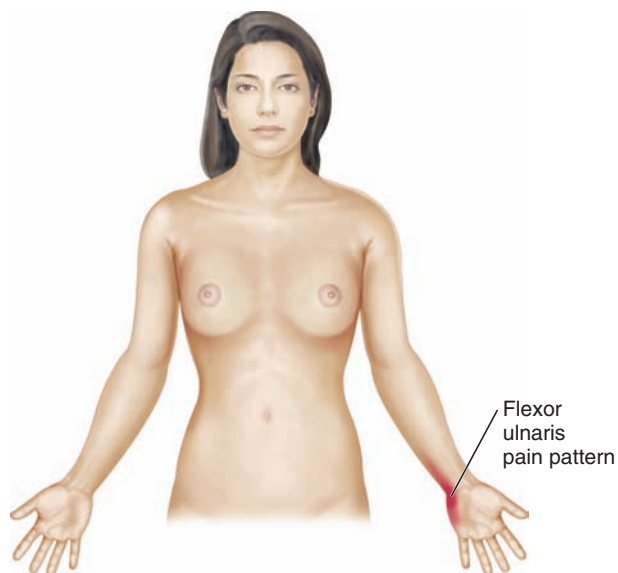


FIGURE 10.4 **Flexor Carpi Ulnaris Referred Pain Pattern**

PALMARIS LONGUS, FIGURES 10.5 AND 10.6

ORIGIN Medial epicondyle of humerus

INSERTION Palmar aponeurosis and flexor retinaculum

ACTION Flexes fingers and hand

MYOTOME C6, C7

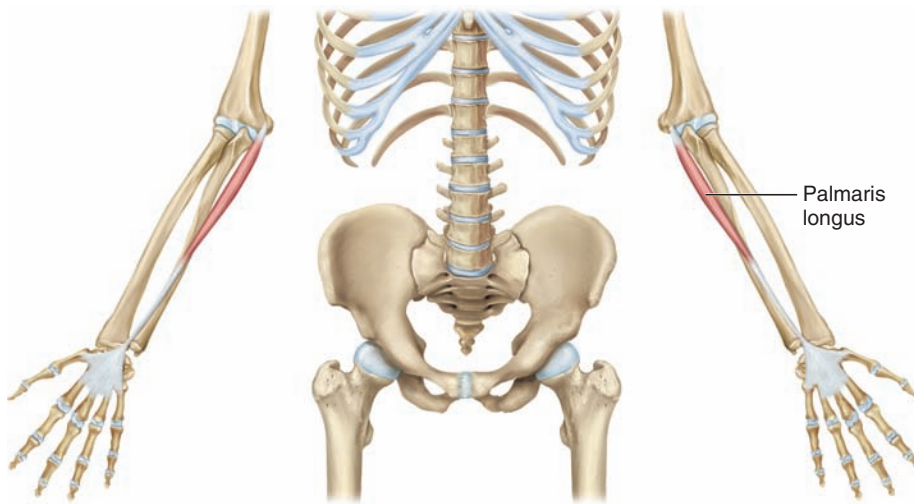


FIGURE 10.5 **Palmaris Longus Muscles**

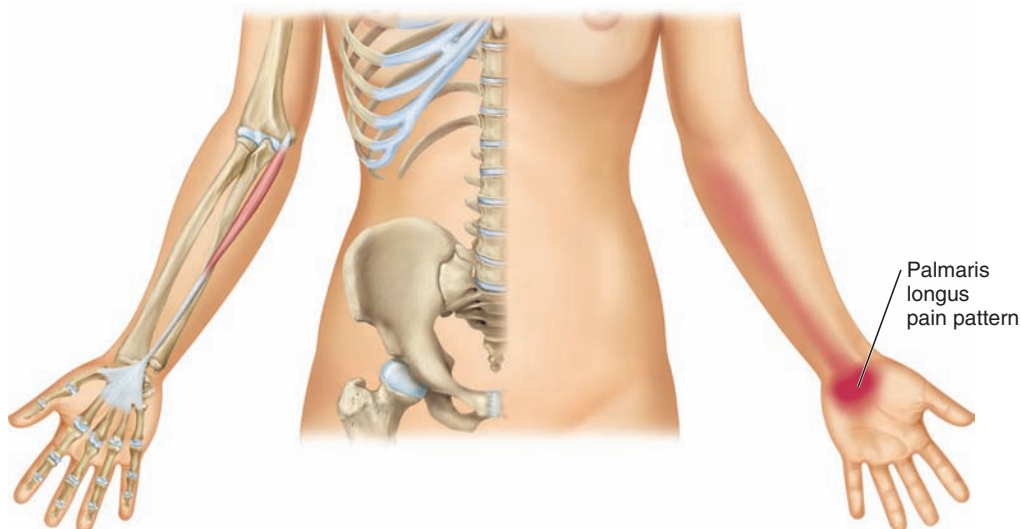


FIGURE 10.6 **Palmaris Longus Muscle and Referred Pain Pattern**

CLINICAL NOTES: Flexors of the Wrist, Hand, and Fingers

The wrist flexors originate from a common reflex tendon that attaches to the medial epicondyle of the humerus. They travel the length of the medial forearm, cross the wrist joint, and insert at various locations on the palm of the hand, relative to their function. As a functional unit, the flexor muscles draw the wrist, hand, and fingers into a flexed position similar to the fetal position of the body.

Awkward, repetitious movements of the wrist can cause repetitive motion injury, cumulative trauma disorder, carpal tunnel syndrome, and/or local nonsystemic arthritis of the wrist and fingers. This is common among people who spend long hours using a keyboard.

Also, awkward, repetitive movements of the elbow can cause intense localized pain on the medial epicondyle of the humerus, also known as *golfer's elbow* or medial epicondylitis. This inflammation is due to a combination of muscular overload (overdoing it) and a series of improper movement patterns (doing it wrong).

When intrajoint pressure and pain are present in the hand, wrist, or elbow, treatment should be focused to the muscle bellies rather than on the local site of pain. Reducing the chronic excess muscle and nerve tension in the muscle bellies will have the greatest impact on decreasing the intrajoint pressure and pain at the elbow and wrist.

Include subscapularis and the scalenes in treatment plans when pain in the wrist is present. These are two sources of wrist pain that are often overlooked. The subscapularis can refer pain that encompasses the wrist. The scalenes can cause numbness, tingling, and shooting pain of the wrist (carpal tunnel syndrome symptoms) from cervical nerve root irritation and/or brachial plexus entrapment.

ROUTINE: Flexors of the Wrist, Hand, and Fingers

Position of client: supine, with the client's arm extended away from the body. Support the arm with an extended bolster if the arm does not fit on the table, but allow the client's hand to hang off the table.

1. Hold the client's fingers in a hyperextended position. Using the fingertips, treat the muscular divisions with slow, deep effleurage from the hand to the shoulder. (See Figure 10.7.)
2. Extend and stretch the tendon lines of each finger. Using the thumbs, treat the individual tendon lines from the fingertips to the wrist with compression and cross-fiber friction. Isolate and traction each digit independently. Continue the treatment while performing range of motion of each joint of the fingers. (See Figure 10.8.)
3. Using thumbs, friction the muscles throughout the palmar surface of the hand.



FIGURE 10.7

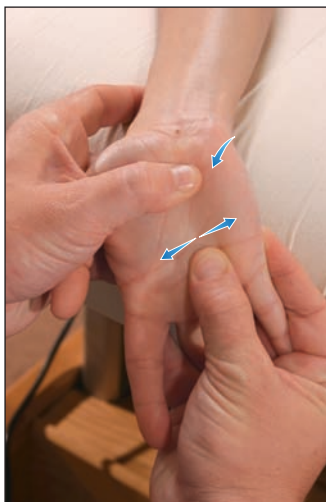


FIGURE 10.8



FIGURE 10.9

4. Interlock both of your hands with the client's hand. Extend the client's wrist, and pull the fingers apart. Using your thumbs, spread the palmar aponeurosis and myofascia. (See Figure 10.9.)
5. Hyperextend and stabilize the client's hand. Using the palms, a collapsed fist, or the thumbs, apply compression and slow, deep effleurage along the forearm from the wrist to the crease of the elbow, ending medially at the common tendon attachment site of the wrist flexors. (See Figure 10.10.)
6. Using the fingertips, treat the flexors with specific parallel friction in 1-inch segments. Hold static compression to hypersensitive areas. (See Figure 10.11.)
7. With one hand, flex the client's elbow at a 45-degree angle. Using the other hand, petrissage the entire forearm in a centripetal direction. (See Figure 10.12.)
8. Using a contoured hand, effleurage the entire forearm.



FIGURE 10.10



FIGURE 10.11

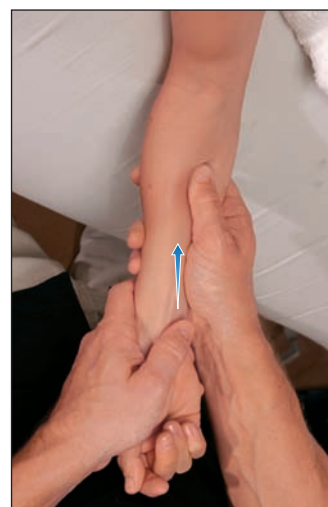


FIGURE 10.12

PRONATOR TERES, FIGURES 10.13 AND 10.14

ORIGIN Medial epicondyle of humerus

INSERTION Lateral shaft of radius

ACTION Pronates the forearm; assists in flexion of elbow

MYOTOME C6, C7

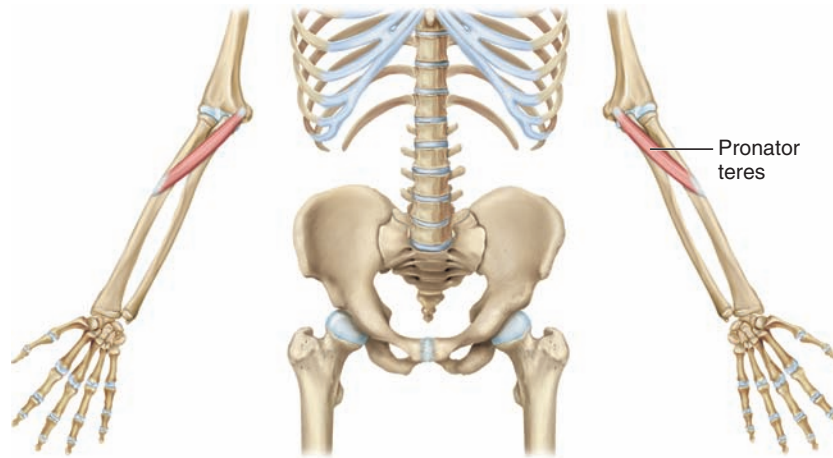


FIGURE 10.13 **Pronator Teres Muscles**

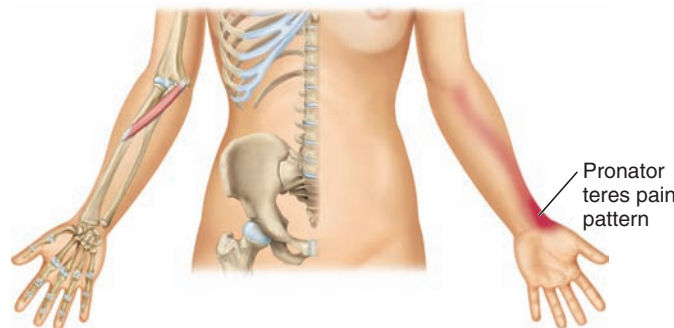


FIGURE 10.14 **Pronator Teres Muscle and Referred Pain Pattern**

CLINICAL NOTES: Pronator Teres

The pronator teres muscle originates on the medial epicondyle of the humerus, just superior to the attachment of the flexors. Traveling obliquely across the anterior forearm, the pronator teres inserts midway down the forearm on the radius. It is the strongest pronator of the forearm at the

elbow joint and often shortens among people who spend long hours using a keyboard. The median nerve that supplies the pronator teres travels between the muscle fibers and is susceptible to entrapment. This can cause carpal tunnel symptoms, particularly pain along the distal radius at the base of the thumb.

ROUTINE: Pronator Teres

Position of client: supine, with the arm supinated.

1. Isolate the pronator teres muscle. Using the fingertips or thumbs, treat the pronator teres where it crosses the forearm with static compression and cross-fiber friction in 1-inch segments. (See Figure 10.15.)
2. Using the fingertips, treat the intermuscular septum at all borders of the pronator teres.
3. Use one hand to passively stretch the forearm into supination. Using the other hand, isolate the pronator teres and treat the muscle belly with slow, deep compression and friction. (See Figure 10.16.)

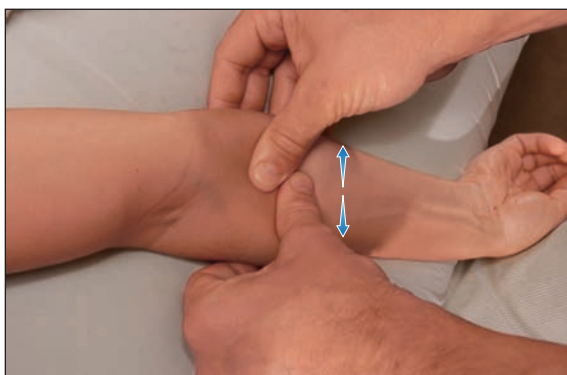


FIGURE 10.15



FIGURE 10.16

BRACHIORADIALIS, FIGURES 10.17 AND 10.18

ORIGIN Lateral supracondylar ridge of humerus

INSERTION Styloid process of radius

ACTION Assists flexion at elbow

MYOTOME C6

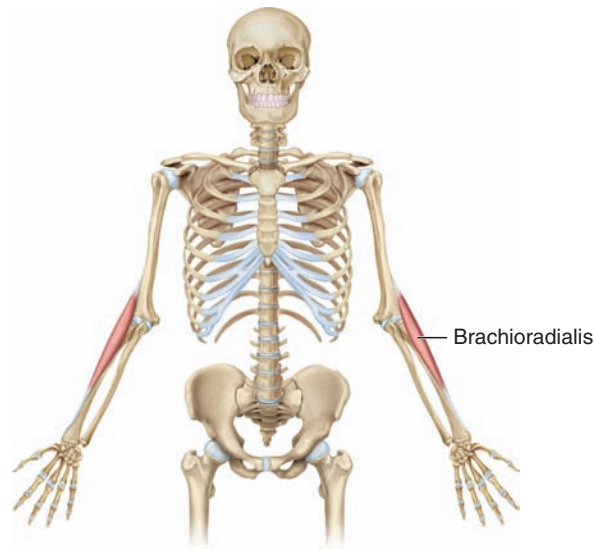


FIGURE 10.17 **Brachioradialis Muscles**

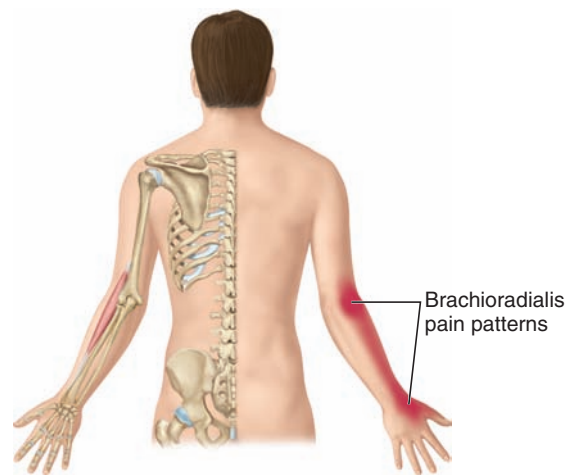


FIGURE 10.18 **Brachioradialis Muscle and Referred Pain Pattern**

CLINICAL NOTES: Brachioradialis

The brachioradialis is the most superficial muscle on the lateral surface of the forearm; it travels from the humerus to the styloid process of the radius, forming the lateral contour of the forearm. The brachioradialis muscle flexes the elbow when the forearm is in the neutral position (between supination and pronation). This movement is commonly called the “hammer curl.”

Hypertonicity in the brachioradialis or the hand extensors can cause pain in the radial and dorsal parts of the wrist. The brachioradialis and supinator have similar pain patterns on the lateral epicondyle, with referral pain in the web of the thumb. These two muscles are often overlooked as a source of acute pain of the lateral elbow during full arm extension.

A treatment plan that includes the brachioradialis should also include the supinator, extensor carpi ulnaris, extensor carpi radialis brevis, and extensor carpi radialis longus. These muscles are associated with symptoms of epicondylitis, also known as *tennis elbow*.

Stiff fingers, painful wrists, and a weak grip are all indications for treating the brachioradialis and the hand extensors. If left untreated, a hypertonic brachioradialis muscle can be debilitating and cause a person to guard against awkward and stressful positions of the elbow, wrist, and hand.

When using deep-friction techniques around the radius, avoid the radial nerve that penetrates the supinator and extensor muscles.

To restore proper function to the brachioradialis, it is important that the client learn stretching exercises that can be practiced two to three times a day for 10 to 20 minutes. This will help avoid chronic problems, especially if an occupation puts the client at risk for repetitive strain injuries.

ROUTINE: Brachioradialis

Position of client: supine, with the client's arm in a neutral position between supination and pronation.

1. Using the fingertips, treat the brachioradialis with slow, deep effleurage from the wrist to elbow, separating the muscular divisions.
2. Using both hands, *outline* the muscle borders of the brachioradialis by picking up segments of the muscle belly from wrist to elbow.
3. Using the fingers and thumbs, pick up the brachioradialis and treat with deep, static *compression*, moving in 1-inch segments from wrist to elbow.
4. Using the fingers and thumbs, pick up brachioradialis and use the thumbs to treat with *friction* in one direction, moving in 1-inch segments from wrist to elbow. (See Figure 10.19 for these steps.)
5. Have the client flex the thumb and tuck it into the fist. Use one hand to lightly passively stretch the hand toward the ulna. Use the other hand to glide into the intermuscular septum, treating the borders of the brachioradialis muscle. (See Figure 10.20.)

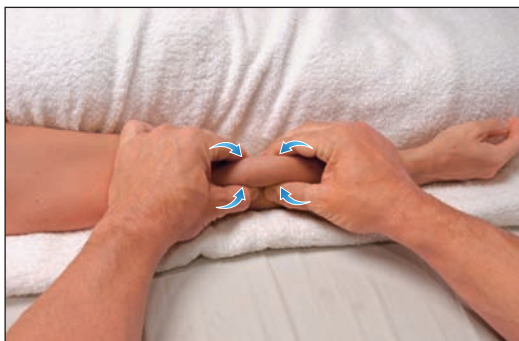


FIGURE 10.19

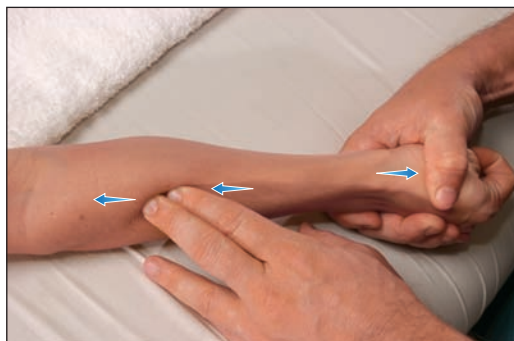


FIGURE 10.20

6. With one hand, flex the client's elbow at a 45-degree angle. Using the other hand, petrissage the entire forearm in a centripetal direction. (See Figure 10.21.)
7. Using a contoured hand, effleurage the entire forearm.



FIGURE 10.21

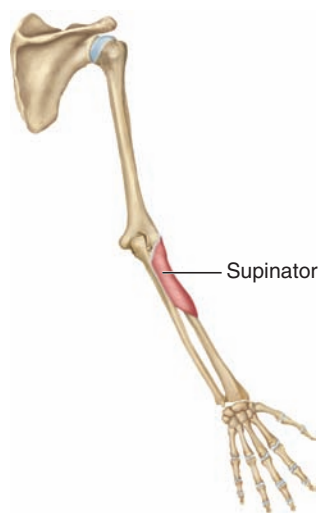
SUPINATOR, FIGURES 10.22 AND 10.23

ORIGIN Lateral epicondyle of humerus; below radial notch on posterior ulna, wrapping around radius to insertion attachment

INSERTION Anterior proximal radius

ACTION Supinates forearm; assists in flexion of elbow

MYOTOME C5, C6

FIGURE 10.22 **Supinator Muscle**

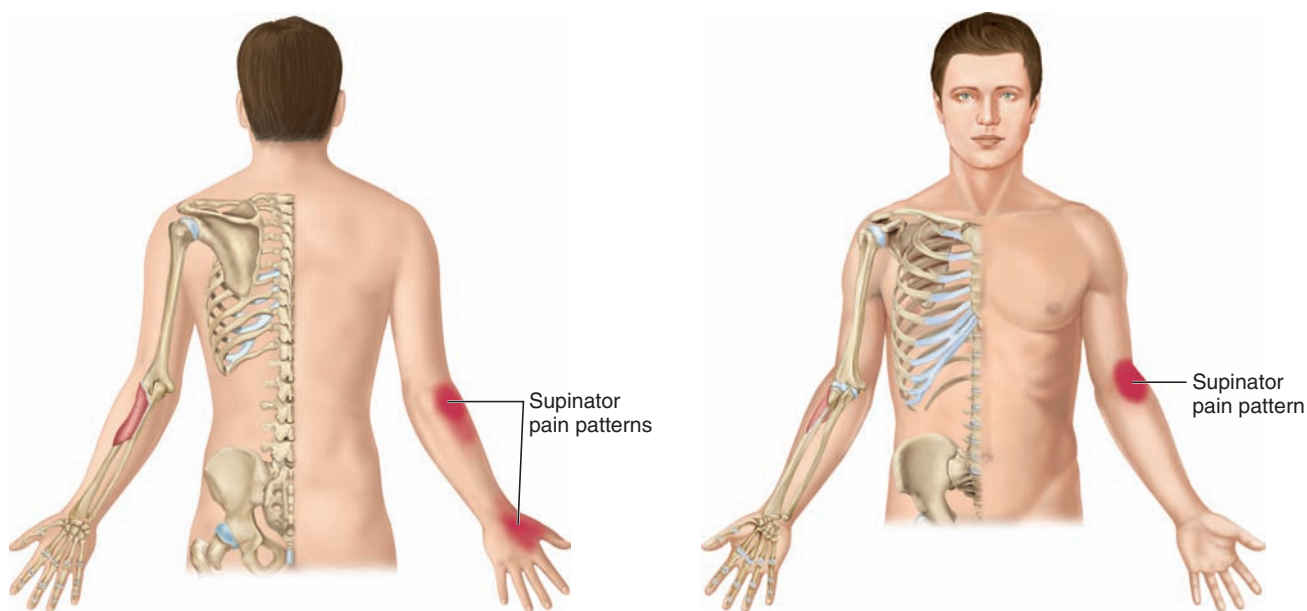


FIGURE 10.23 **Supinator Muscle and Referred Pain Patterns**

CLINICAL NOTES: Supinator

The supinator muscle wraps around the posterior radius. Its primary function is to supinate the forearm with assistance from the biceps brachii on forced supination.

Repetitive shortening of the supinator muscle can cause chronic pain. Shaking hands with a firm grip or turning tight jar lids can compound the pain and weakness. Trigger points in the supinator muscle refer pain primarily to the lateral epicondyle of the humerus, with some referred pain to the wrist and web of the thumb. Tennis elbow is often the medical diagnosis when a person experiences pain on the lateral epicondyle. If elbow pain or dysfunction is present, treatment should include the triceps, biceps, anconeus, brachioradialis, brachialis, and pronator teres from origins to insertions to eliminate any possible nerve entrapments and to ensure full elbow extension.

The radial nerve can become compressed between the humerus and the supinator as it travels over the radial-ulnar joint. The radial nerve can also become entrapped between the superficial and deep fibers of the supinator. A radial nerve compression will elicit a motor, not sensory, reaction; bumping the elbow or pressure on the muscle can elicit an acute onset of pain similar to an electric shock, as well as weakness in the hand.

When treating tennis elbow symptoms (epicondylitis), deliver pressure to the muscle bellies rather than direct pressure on the painful bone site. Reducing the excess tension in the muscle bellies will often reduce the stress at the actual pain site on the bone surface. When delivering treatment around acutely inflamed areas, follow-up with the application of ice massage for 8 to 10 minutes.

ROUTINE: Supinator

Position of client: supine, with elbow slightly flexed.

1. Using both hands, treat the muscles of the forearm with effleurage and petrissage from the wrist to the elbow.
2. To reach the supinator muscle directly underneath the brachioradialis, displace the brachioradialis and use the fingertips to press directly inward until you feel the radial bone. (See Figure 10.24.)
3. Using flexed contoured fingertips, treat the biceps brachii and the supinator approximately 2 inches below the crease of the elbow with static compression and light circular friction. (See Figure 10.25.)
4. Using the fingertips, treat the radius on the anterior side of the forearm with compression and friction. Stay underneath the brachioradialis, and continue treatment all the way around the radius until you reach the posterior forearm. (See Figure 10.26.)

Place the client's arm in an extended position along the body.

5. Using the fingertips, treat the entire posterior forearm with compression and friction. (See Figure 10.27.)
6. Effleurage the entire forearm.

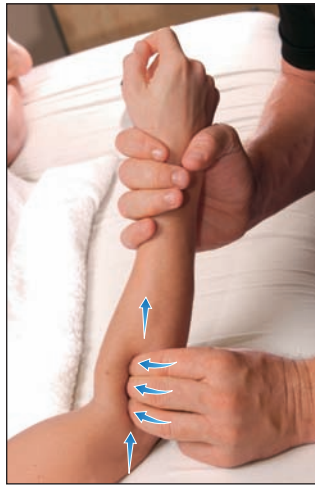


FIGURE 10.24



FIGURE 10.25

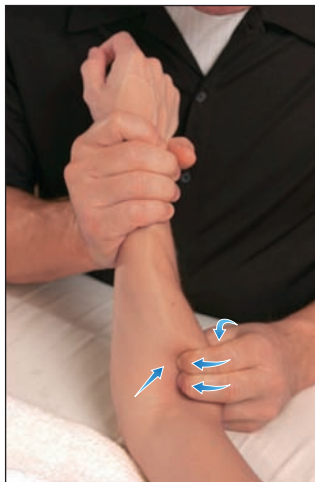


FIGURE 10.26



FIGURE 10.27

BICEPS BRACHII, FIGURES 10.28 AND 10.29

ORIGIN *Short head:* coracoid process of scapula

Long head: supraglenoid tubercle of scapula

INSERTION Tuberosity of radius

ACTION Flexes and supinates forearm at elbow; flexes arm at shoulder

MYOTOME

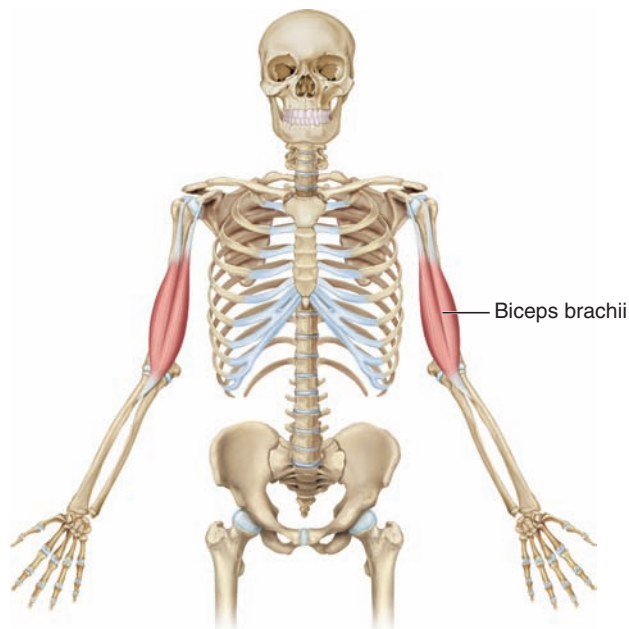


FIGURE 10.28 **Biceps Brachii Muscles**

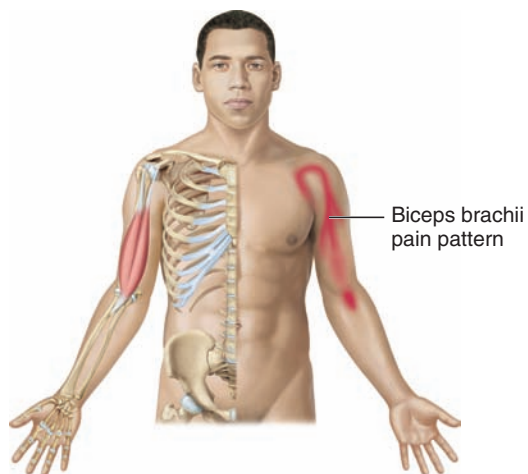


FIGURE 10.29 **Biceps Brachii Muscle and Referred Pain Pattern**

BRACHIALIS, FIGURES 10.30 AND 10.31

ORIGIN Distal half of anterior shaft of humerus

INSERTION Tuberosity of the ulna

ACTION Flexes forearm at elbow

MYOTOME C5, C6

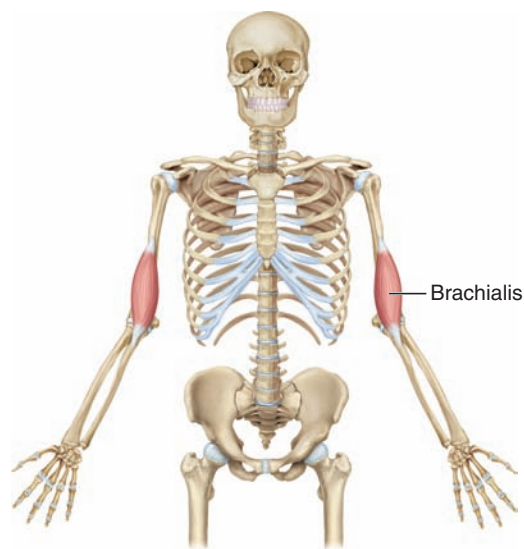


FIGURE 10.30 **Brachialis Muscles**

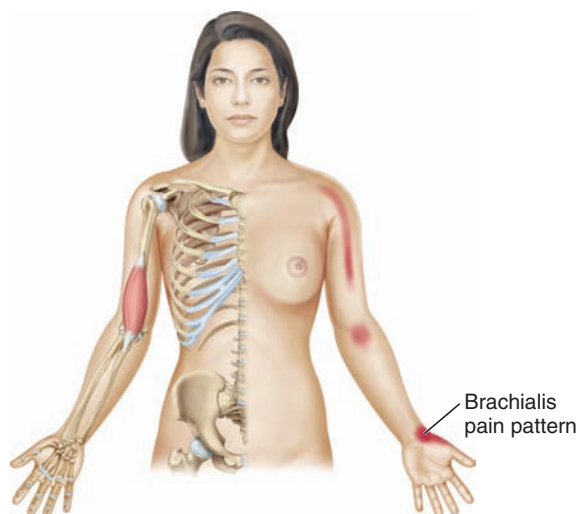


FIGURE 10.31 **Brachialis Muscle and Referred Pain Pattern**

CORACOBRACHIALIS, FIGURES 10.32 AND 10.33

ORIGIN Coracoid process of scapula

INSERTION Medial shaft of humerus

ACTION Flexes arm; assists adduction of arm at shoulder

MYOTOME C6, C7

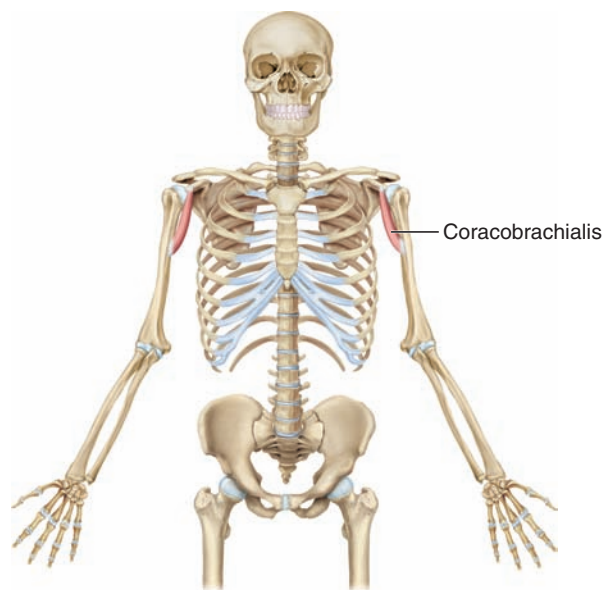


FIGURE 10.32 **Coracobrachialis Muscle**

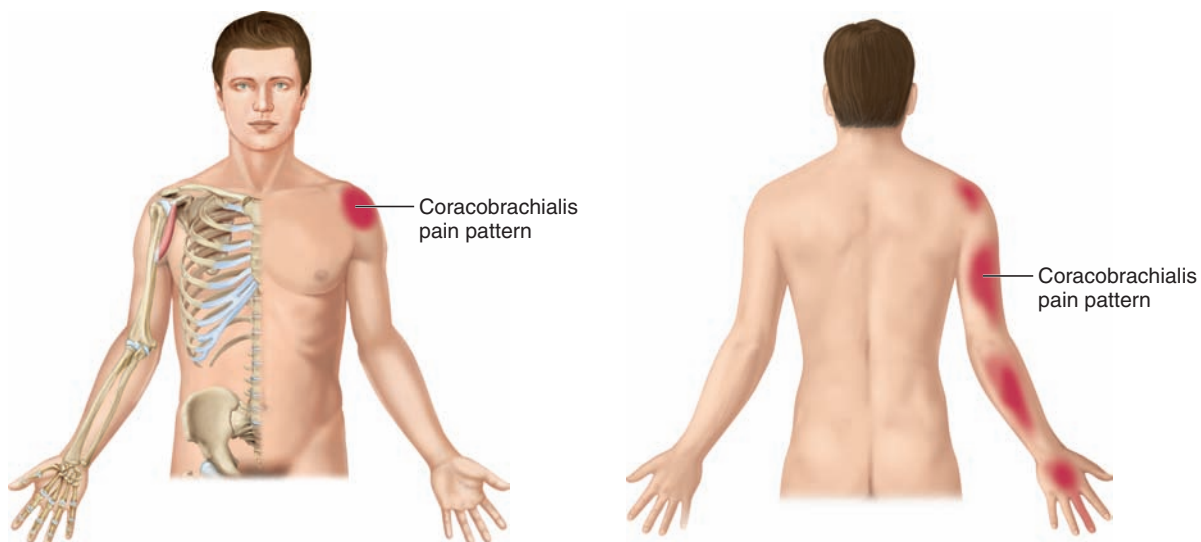


FIGURE 10.33 **Coracobrachialis Muscle and Referred Pain Patterns**

CLINICAL NOTES: Biceps Brachii, Brachialis, and Coracobrachialis

The biceps brachii, brachialis, and coracobrachialis muscles lie on the anterior aspect of the humerus. The two-headed biceps brachii muscle is the most superficial of the three and has functions that act on the elbow and shoulder joints. Since the biceps brachii spans two joints, it has to ration its strength over the two. Distally, the biceps brachii functions as a synergist (assistant) to the brachialis and brachioradialis muscles in flexing the forearm at the elbow. It is also a strong assistant to the primary supinator muscle when the forearm is pronated and flexed. Proximally, the biceps brachii serves to assist the anterior deltoid and coracobrachialis muscles in flexing the arm at the shoulder.

The brachialis muscle is the deepest and strongest and expands only one joint, the elbow; therefore, it is the primary flexor of the elbow.

The coracobrachialis muscle lies midway up and medial on the shaft of the humerus and serves as a synergist to the anterior deltoid and biceps brachii in flexing the arm at the shoulder. Since it lies medial on the humerus, it also assists the pectoralis major in adducting the arm toward the body. The coracoid process of the scapula is a distinctive bony landmark that projects anterior and lateral on the upper chest just below the clavicles. The coracoid process is worth mentioning as it anchors the scapula to the front of the body by the pectoralis minor, which is under the pectoralis major. This is also where the coracobrachialis and the short head of the biceps attach.

The biceps brachii and brachialis muscles have similar pain patterns that are local within the upper and lower aspects of the arm. Pain within the crease of the elbow will most likely stem from repetitive movements and chronic muscular overload of the elbow flexors. Lengthening the brachialis muscle is most important as this will have the biggest impact on straightening the forearm at the elbow. The supinator, biceps brachii, and brachioradialis muscles need to be isolated and treated as well to ensure a full release of the muscular tension that manifests within the elbow.

ROUTINE: Biceps Brachii, Brachialis, and Coracobrachialis

Position of client: supine, with the client's arm extended away from the body. Support the arm with an extended bolster if the arm does not fit on the table, but allow the client's hand to hang off the table.

1. Using both hands, treat the arm with effleurage and petrissage from the elbow to the shoulder.
2. Using fingertips, treat with slow, deep effleurage, separating the muscular divisions of the two heads of the biceps brachii. (See Figure 10.34.)
3. Using the fingers and thumbs, pick up the biceps brachii and treat with static compression and friction, moving in 1-inch segments from elbow to shoulder. (See Figure 10.35.)

Practice isolating the two heads of the biceps brachii individually.

4. Using a contoured hand and the proper use of body weight, apply slow effleurage to the entire arm. Hold static compression and maintain the client's edge to hypersensitive areas. (See Figure 10.36.)



FIGURE 10.34



FIGURE 10.35

5. Using gliding fingertips moving in a superior direction, explore and treat the intermuscular between brachialis and the overlying biceps brachii. (See Figure 10.37.)
6. Using fingertips of one hand, treat the brachialis with static compression at each contact point. Direct the compression in and down; compressing the muscle onto the bone. Simultaneously, use contoured hand and fingertips of the other hand to treat the opposite border with compression. Treat both medially and laterally. (See Figure 10.38.)

Flex the client's elbow, and rest the forearm on a folded towel or pillow between your chest and the client's forearm.

7. Using the fingertips, treat the belly of the brachialis muscle on both sides with static compression at each contact site. Move in 1-inch segments while compressing the muscle onto the humerus. (See Figure 10.39.)
8. Using the fingers, treat the coracobrachialis on the medial and upper shaft of the humerus with slow, deep effleurage. (See Figure 10.40.)



FIGURE 10.36



FIGURE 10.37

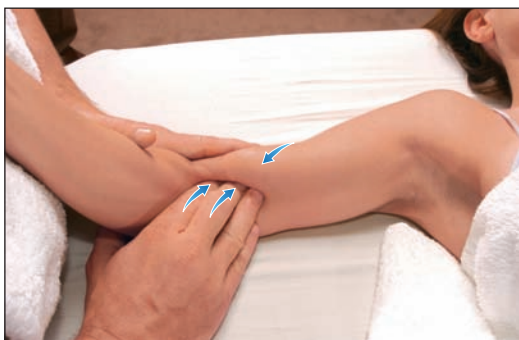


FIGURE 10.38

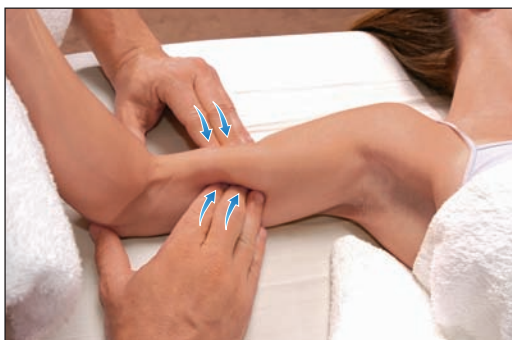


FIGURE 10.39

9. Using contoured hands, effleurage the upper arm.
10. Using contoured hands, effleurage the entire arm from wrist to shoulder.

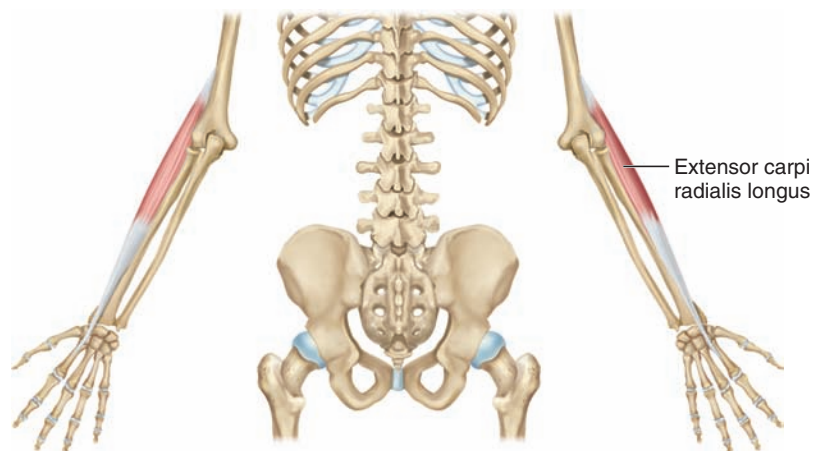


FIGURE 10.40

EXTENSORS OF THE WRIST, HAND, AND FINGERS

EXTENSOR CARPI RADIALIS LONGUS, FIGURES 10.41 AND 10.42

ORIGIN	Lateral supracondylar ridge of humerus, common extensor tendon on lateral epicondyle of humerus
INSERTION	Base of 2nd metacarpal
ACTION	Extends and radially abducts hand at wrist
MYOTOME	C6, C7

FIGURE 10.41 **Extensor Carpi Radialis Longus Muscles**

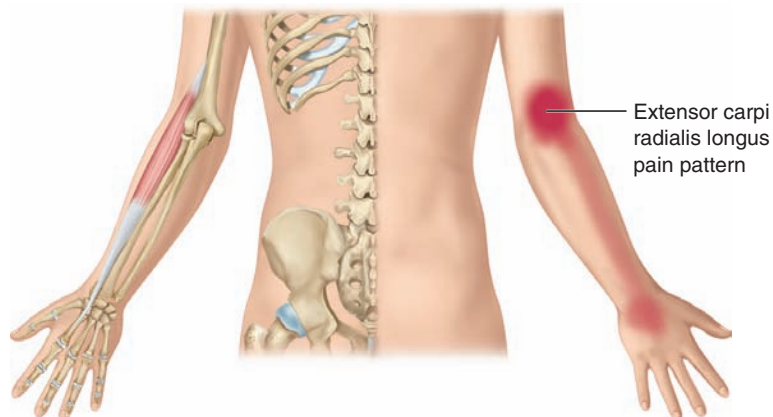


FIGURE 10.42 **Extensor Carpi Radialis Longus Muscle and Referred Pain Pattern**

EXTENSOR CARPI RADIALIS BREVIS, FIGURES 10.43 AND 10.44

ORIGIN Common extensor tendon on lateral epicondyle of humerus

INSERTION Base of 3rd metacarpal

ACTION Extends hand; assists radial abduction of hand

MYOTOME C6, C7

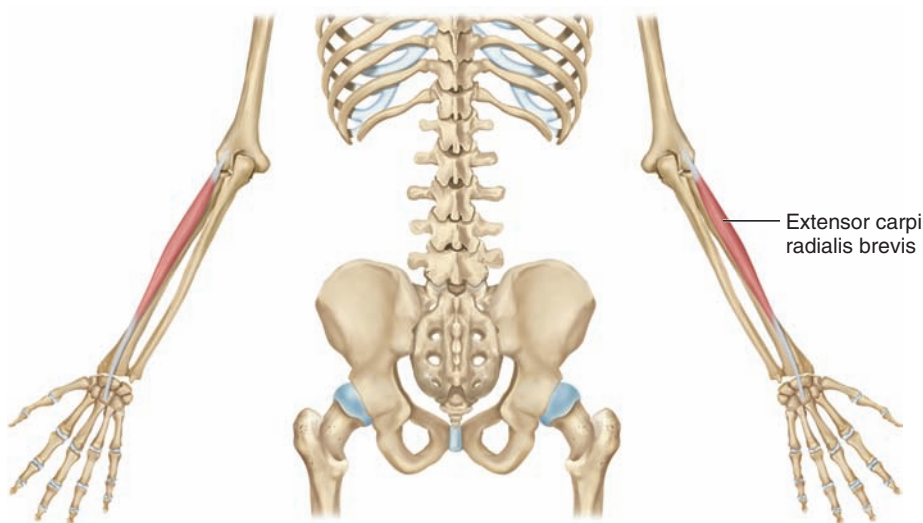


FIGURE 10.43 **Extensor Carpi Radialis Brevis Muscles**

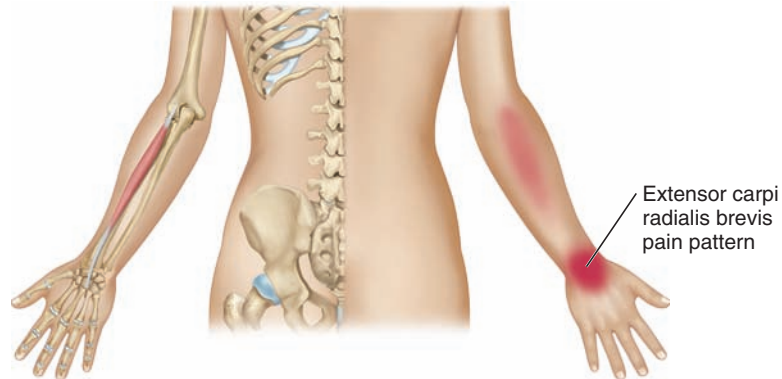


FIGURE 10.44 **Extensor Carpi Radialis Brevis Muscle and Referred Pain Pattern**

EXTENSOR CARPI ULNARIS, FIGURES 10.45 AND 10.46

ORIGIN	Common extensor tendon on lateral epicondyle of humerus, posterior proximal ulna
INSERTION	Base of 5th metacarpal
ACTION	Extends ulnar; abducts hand at wrist
MYOTOME	C6–C8

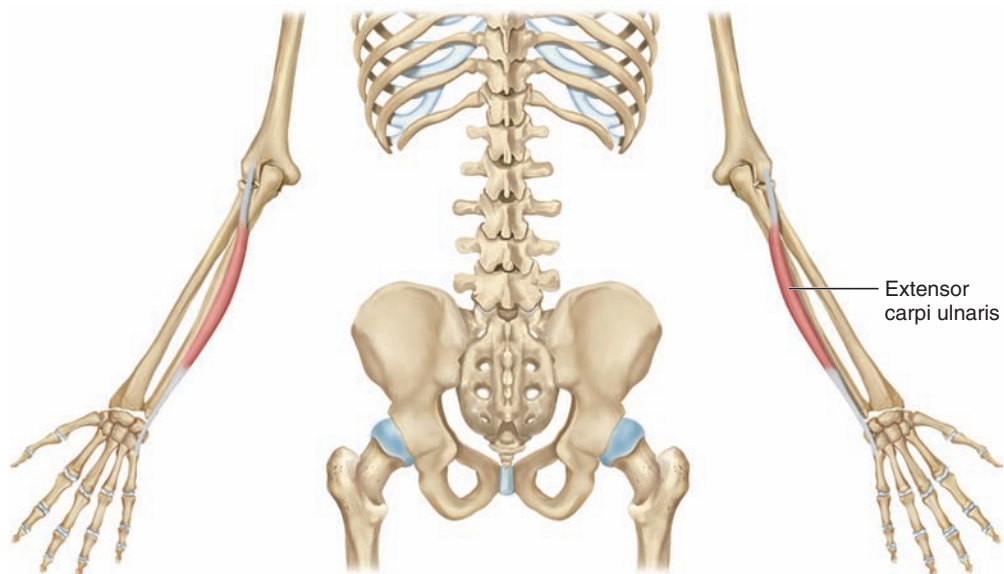


FIGURE 10.45 **Extensor Carpi Ulnaris Muscles**

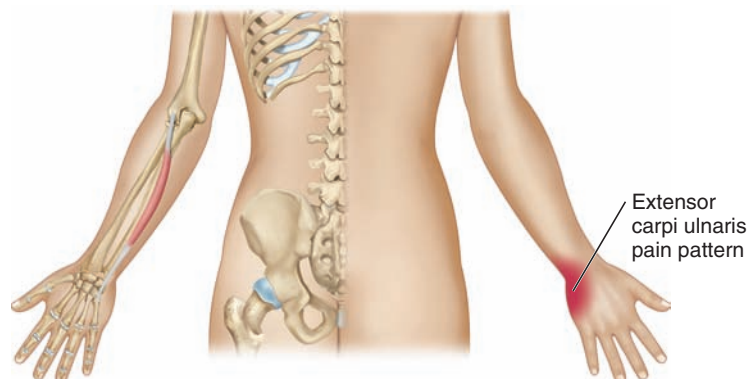


FIGURE 10.46 **Extensor Carpi Ulnaris Muscle and Referred Pain Pattern**

CLINICAL NOTES: Extensors of the Wrist, Hand, and Fingers

The extensors originate from a common tendon that attaches to the lateral epicondyle of the humerus. They all travel the length of the lateral forearm, cross the wrist joint, and attach at various locations on the top of the hand, relative to their function. As a functional unit, the extensor muscles extend the hand and fingers.

Also, awkward, repetitive movements of the elbow can cause intense localized pain on the lateral epicondyle of the humerus, also known as *tennis elbow* or lateral epicondylitis. The pain of tennis elbow can be experienced as “bone pain” directly on the lateral epicondyle. Inflammation of the lateral epicondyle is often brought on by excess muscle tension in the extensor muscles. Muscular overload from long hours at a keyboard or an improper technique of a tennis or golf swing can perpetuate this inflammation.

Treatment should be focused to the muscle bellies rather than on the local site of pain. Reducing the chronic excess muscle and nerve tension in the muscle bellies will have the greatest impact on decreasing the inflammation of the periosteum causing the lateral epicondylitis.

ROUTINE: Extensors of the Wrist, Hand, and Fingers

Position of client: supine, with the client’s arm in a neutral position between supination and pronation.

1. Have the client hold her hand in a loose fist. Using the fingertips, treat the muscular divisions with static compression at each contact site from wrist to elbow. (See Figure 10.47.)
2. Use one hand to passively flex the client’s hand and tendon line of each finger. Using the fingertips or thumbs, treat the individual tendon lines from the fingertips to the wrist with compression and friction. (See Figure 10.48.)



FIGURE 10.47



FIGURE 10.48

3. Isolate and traction each digit independently. Continue tendon work while performing range of motion of each finger joint.
4. Using a contoured palm, apply a slow, deep effleurage. Hold static compression and maintain the client's edge to hypersensitive areas.
5. Use one hand to stabilize the wrist and keep the client's elbow flexed at 45 degrees. Use the other hand to firmly petrissage the entire extensor group of the forearm. (See Figure 10.49.)
6. Next, continue with effleurage to the entire forearm.
7. Decompress the wrist using traction. While one arm anchors and tractions the wrist with interlocking fingers, the thumb of the other hand apply compression and friction to the wrist. (See Figure 10.50.)
8. Using contoured hands, effleurage the entire forearm.



FIGURE 10.49

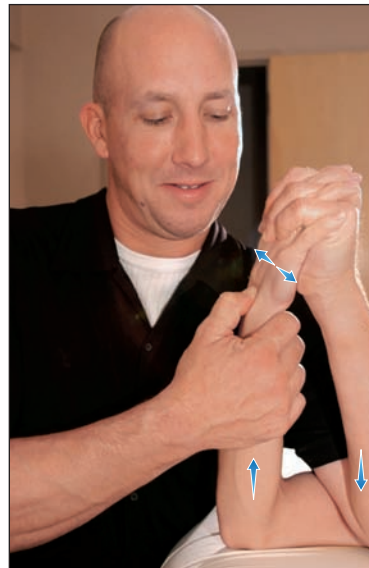


FIGURE 10.50

TRICEPS BRACHII, FIGURES 10.51 AND 10.52

ORIGIN *Long head:* infraglenoid tubercle of scapula

Lateral head: posterior humerus

Medial head: posterior humerus

INSERTION Olecranon process of ulna

ACTION Extends forearm; assists in adduction of arm

MYOTOME C7, C8

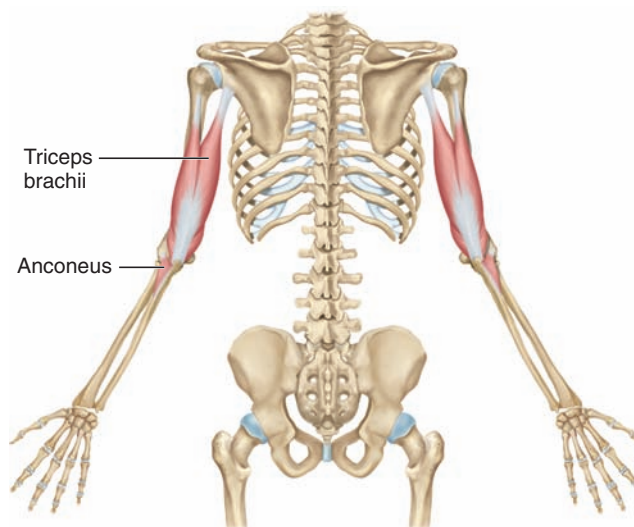


FIGURE 10.51 **Triceps Brachii and Anconeus Muscles**

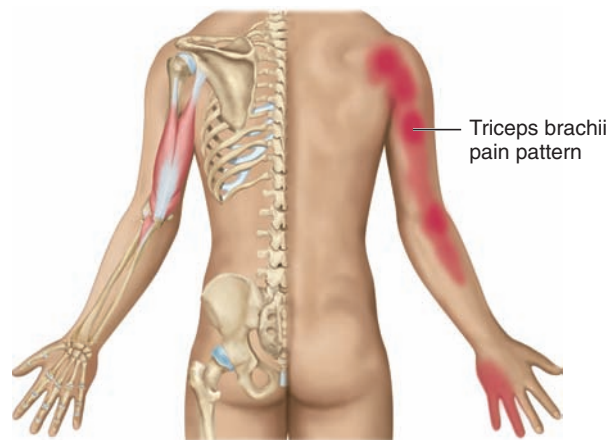


FIGURE 10.52 **Triceps Brachii Muscle and Referred Pain Pattern**

ANCONEUS, FIGURES 10.51 AND 10.53

ORIGIN	Lateral epicondyle of humerus
INSERTION	Olecranon process of ulna
ACTION	Extends forearm (assists triceps)
MYOTOME	C7, C8

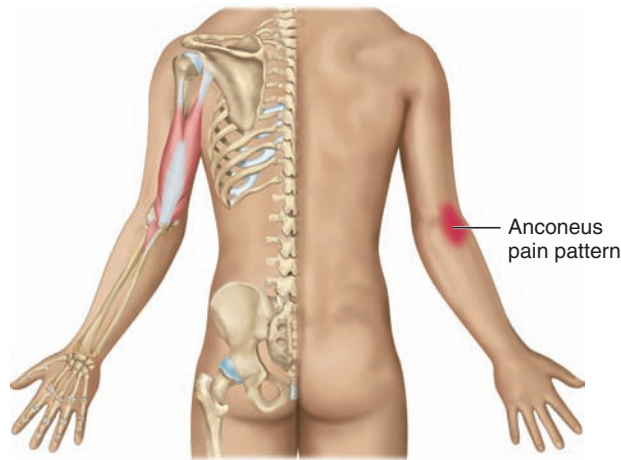


FIGURE 10.53 **Anconeus Muscle and Referred Pain Pattern**

CLINICAL NOTES: Triceps Brachii and Anconeus

The triceps brachii has three heads; the long head, the lateral head, and the medial head. All three merge at their insertion to form a thick reflex tendon that crosses the elbow and anchors to the ulna. The long head originates on the axillary scapula and crosses both the shoulder and the elbow, assisting in full extension movements at both joints. The two shorter divisions, the lateral and medial heads, originate on the posterior humerus and are the primary extensors of the forearm at the elbow joint.

The anconeus is a small triangular continuation of the triceps brachii. It attaches to the lateral epicondyle of the humerus, olecranon process, and the first 3 inches of the proximal ulna. The anconeus assists the triceps brachii with elbow extension.

The pain referral of the triceps brachii encompasses the posterior arm from the shoulder to the fingers, with specific pain to the elbow on forceful extension.

Limited arm flexion at the shoulder (elevating arm to ear) can be an indication of hypertonicity in the triceps brachii, teres major, latissimus dorsi, and/or subscapularis.

ROUTINE: Triceps Brachii and Anconeus

Position of client: prone, with the arm hanging off the therapy table.

1. Using the palm of the hand, treat the triceps brachii with slow, deep effleurage from the elbow to the scapula.
2. Using both hands, outline and pick up the triceps brachii and treat with static compression at each contact site and friction, moving in 1-inch segments from the elbow to the scapula. (See Figure 10.54.)
3. With fingers pointing inward, treat the intermuscular septum that separates the three muscular divisions of the triceps brachii. Using the fingertips or thumbs, glide in a superior direction while lifting the three divisions up and off the humerus. (See Figure 10.55.)
4. Using contoured hands, or a collapsed fist, treat the triceps brachii with slow, deep effleurage. Hold static compression and maintain the client's edge to hypersensitive areas.
5. Isolate the anconeus. Draw an imaginary line from the lateral epicondyle of the humerus to the olecranon process of the ulna. Draw another line from the lateral epicondyle to approximately 2 inches below the elbow joint on the ulna. The lines should form the letter V. Using both thumbs, treat the anconeus muscle with slow, deep compressions at each contact site and lightly apply circular friction. (See Figure 10.56.)



FIGURE 10.54



FIGURE 10.55



FIGURE 10.56

DELTOID, FIGURES 10.57 AND 10.58

ORIGIN	<i>Anterior:</i> distal third of clavicle
	acromion process of scapula
	<i>Posterior:</i> spine of scapula
Deltoid tuberosity of humerus	
ACTION	<i>Flexion:</i> abduction of arm at shoulder
	<i>Middle:</i> abduction of arm at shoulder
	<i>Posterior:</i> extension; abduction of arm at shoulder
MYOTOME	C5, C6

CLINICAL NOTES: Deltoids

The deltoid muscle has three distinct bellies originating from three different locations and inserting together on the deltoid tuberosity of the humerus.

The anterior division of the deltoid assists the coracobrachialis in arm flexion at the shoulder joint. The middle division assists the supraspinatus in horizontal arm abduction at the shoulder joint. The posterior division assists the triceps brachii in arm extension at the shoulder joint.

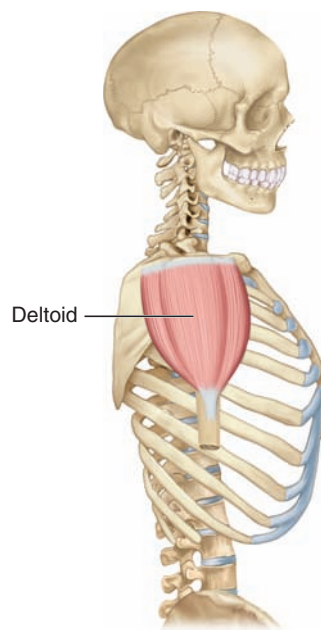


FIGURE 10.57 **Deltoid Muscle**

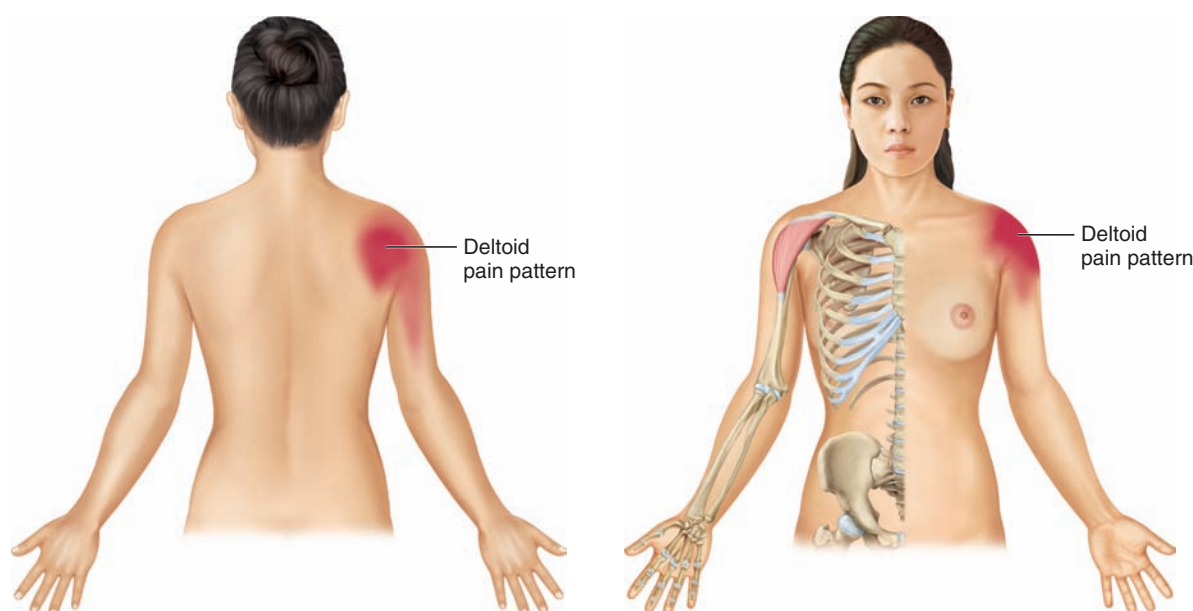


FIGURE 10.58 **Deltoid Muscle and Referred Pain Patterns**

General dull and local pain and weakness of the shoulder during flexion, abduction, and extension strongly indicate deltoid muscle involvement. The three divisions of the deltoid have local pain patterns that do not generally refer pain elsewhere.

Direct trauma or repetitive movements are the primary causes of myofascial shoulder pain. When pain and weakness of the shoulder are present, treat the deltoid muscles and all adjoining and underlying muscles, especially the rotator cuff group.

ROUTINE: Deltoids

Position of client: seated, with the upper body leaning forward and supported. Arms should be at a 90-degree angle to the body to passively shorten the deltoids and provide easy access to all three deltoid divisions. (See Figure 10.59.) Maintain the client's edge during these pick up compressions. No pain means more gain.

1. Using both hands, treat on and around the deltoid muscle with petrissage.
2. Using both hands, isolate the anterior division of the deltoid muscle. Compress and friction in 1-inch segments. (See Figure 10.60.)
3. Using both hands, isolate the middle division of the deltoid muscle. Compress and friction in 1-inch segments. (See Figure 10.61.)
4. Using both hands, isolate the posterior division of the deltoid muscle. Compress and friction in 1-inch segments. (See Figure 10.62.)

5. Using the fingertips, treat the upper fibers of the deltoid muscles along the acromion process, the spine of the scapula, and the distal clavicle with static compression and cross-fiber friction in 1-inch segments. (See Figure 10.63.)
6. Using contoured hands, petrissage the entire shoulder girdle. (See Figure 10.64.)
7. Using contoured hands, effleurage and petrissage the muscles of the arm and shoulder girdle.

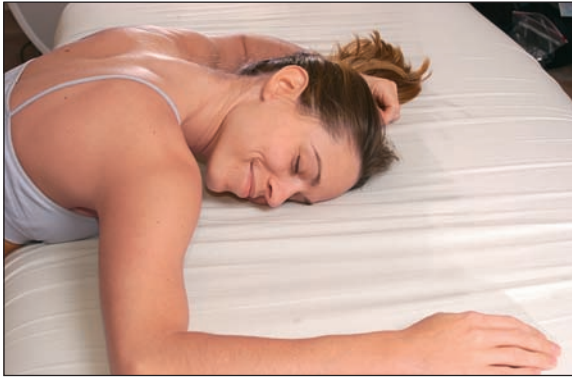


FIGURE 10.59



FIGURE 10.60



FIGURE 10.61



FIGURE 10.62



FIGURE 10.63



FIGURE 10.64

STRETCHING

Standing behind the client, support the shoulder girdle with one hand while the other hand grasps the flexed elbow, pulling the arm toward the rear.

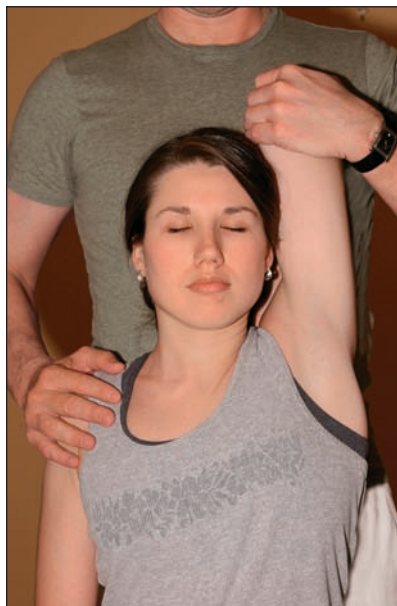


FIGURE 10.65 Assisted upper-arm extremity stretch

Standing behind the client, support the shoulder girdle with one hand while the other hand grasps the flexed elbow, pulling the arm across the body.

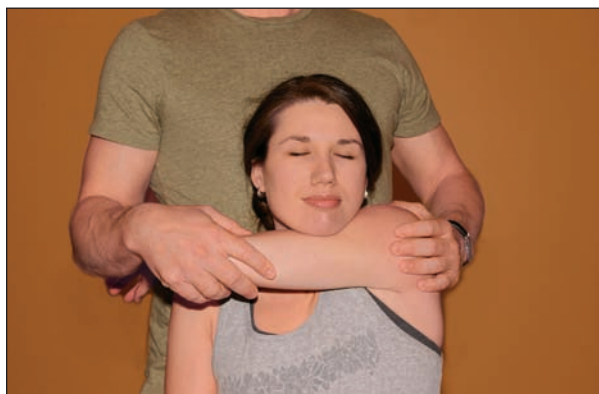


FIGURE 10.66 Assisted upper-extremity and torso stretch

Stand behind the client and grasp both wrists, pulling the arms backward.



FIGURE 10.67 Assisted pectoral and upper-extremity stretch

Position the client's hand so that it is grasping a doorjamb with the thumb pointing toward the floor at shoulder level. Have the client rotate the body away from the doorjamb, stretching the muscles lying on the anterior brachium.

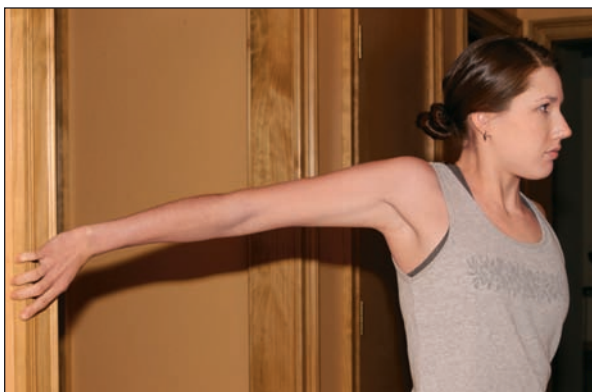


FIGURE 10.68 Upper-arm extremity stretch

Have the client fully extend the arm with the palm facing upward while the other hand grasps the fingers and pulls them back toward the body.



FIGURE 10.69 Hand, wrist, and forearm flexor stretch

Have the client fully extend the arm while making a fist with the palm facing downward while the other

hand grasps the fist and pulls it back toward the body.



FIGURE 10.70 Hand, wrist, and forearm extensor stretch

BRIEF SUMMARY

The upper-extremity compartment (UEC) is a chain of connecting muscles and fascia that arise from the hand, wrist, forearm, and arm and travel up to the bones of the shoulder girdle. The UEC is a pulley system of muscles that attach the upper extremity to the trunk of the body. Postural distortions arise from muscular imbalances of all body planes and affect many joints, including the shoulder, elbow, wrist, hands, and fingers. Treatment to the UEC is delivered in sequence, with treatments starting at the hands, wrist, forearm, arm, and shoulder.

The Clinical Notes boxes in this chapter cover muscular imbalances that affect posture and pain. The Routine boxes and their illustrations provide guidance for proper hand placement in delivering effective therapy techniques. The Stretching box demonstrates specific stretching techniques that are safe, effective, and easy to do.

REVIEW QUESTIONS

1. The wrist flexors originate from a common reflex tendon and attach to what bony landmark?

2. Name two often-overlooked compartment muscles that can refer similar symptoms of pain down the arm to the wrist.

3. What group of forearm muscles originates on the lateral epicondyle of the humerus?

4. Name the strongest pronator of the forearm at the elbow joint.

5. The brachioradialis muscle flexes the elbow when the forearm is in what position?

6. Name the large muscle that overlies the flexor and extensor muscular divisions and can cause a painful, weak grip.

7. The supinator muscle is the primary supinator of the forearm at the elbow joint. Name the muscle that lies proximally on the anterior arm and assists the supinator muscle in supination movements.

8. Name the small triangular muscle that is a continuation of the triceps brachii and assists with forearm extension at the elbow.

9. The deltoid muscle has three distinct bellies originating from the clavicle, acromion, and spine of the scapula. Name the bony landmark where the bellies merge and insert.

10. Hypertonicity of what muscles can cause limited arm flexion at the shoulder (elevating arm to ear)?

CRITICAL-THINKING QUESTIONS

The client complains of pain on the lateral epicondyle of the humerus on straightening the arm.

1. What primary muscle could restrict full extension of the arm?
2. What position of the arm would allow easier access to the muscle for treatment?

APPENDIX A

MUSCLES OF THE BODY

Full Body

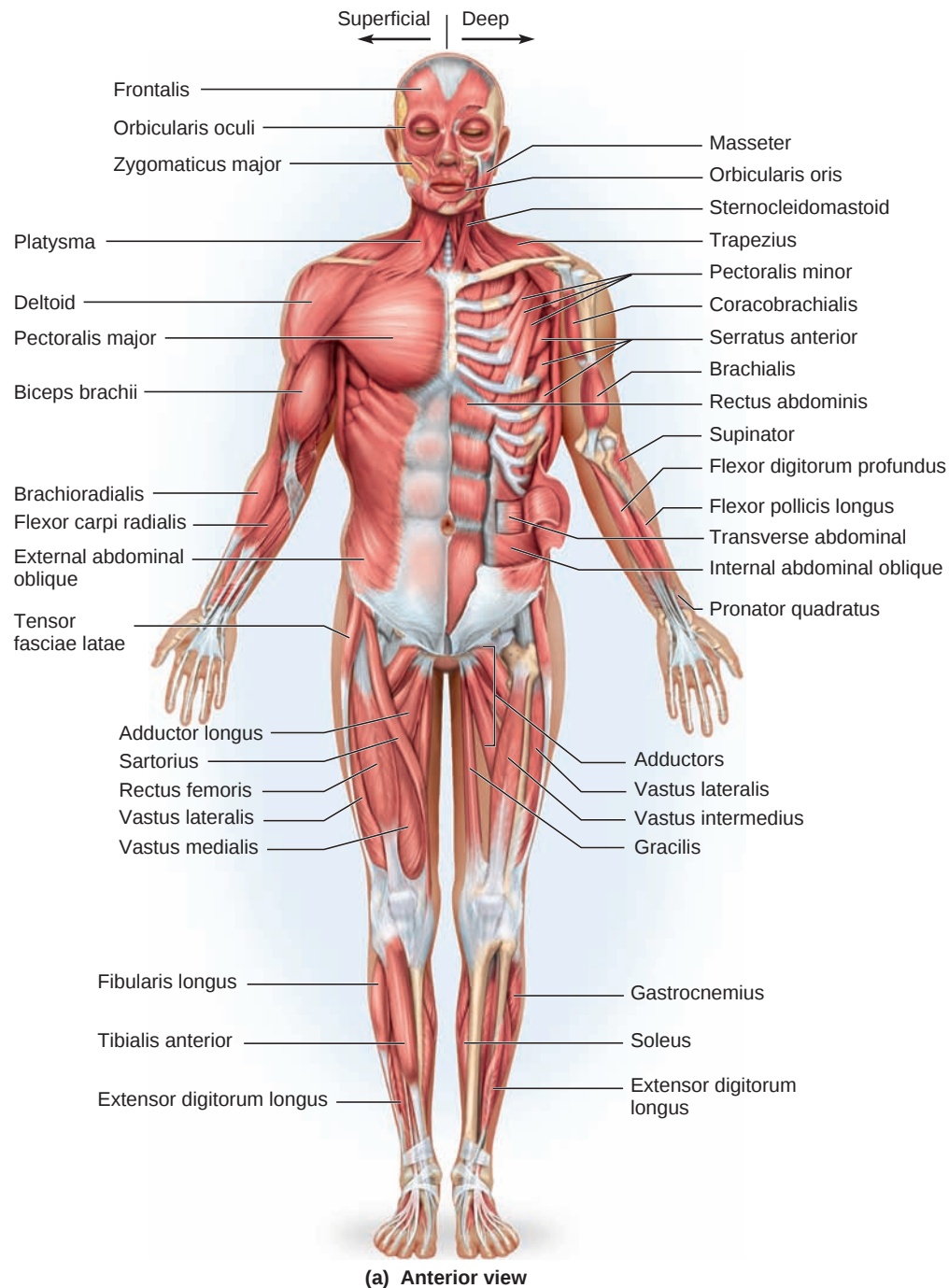


FIGURE A.1 The Muscular System

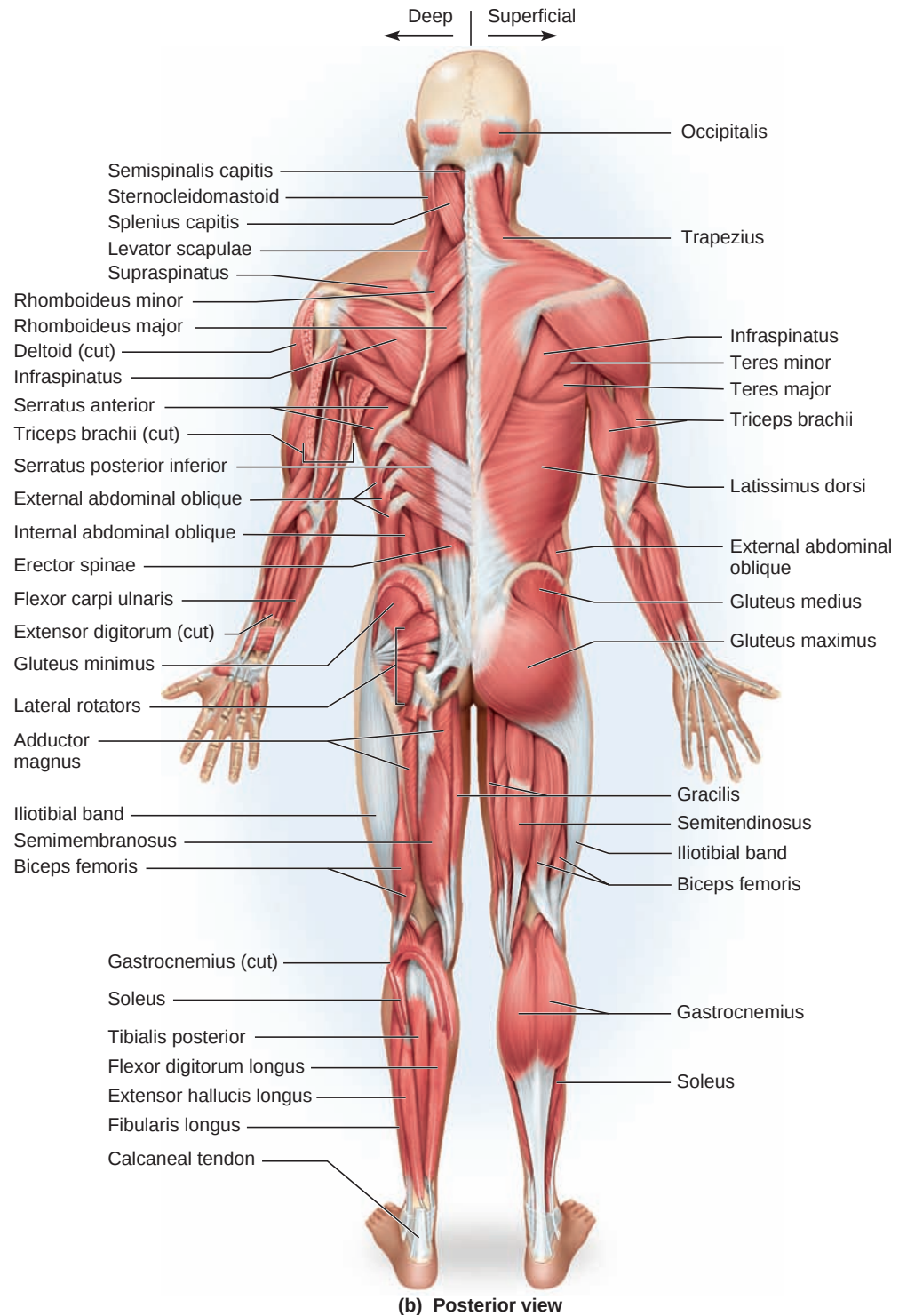


FIGURE A.2 The Muscular System

Posterior Lower-Extremity Compartment (PLEC)

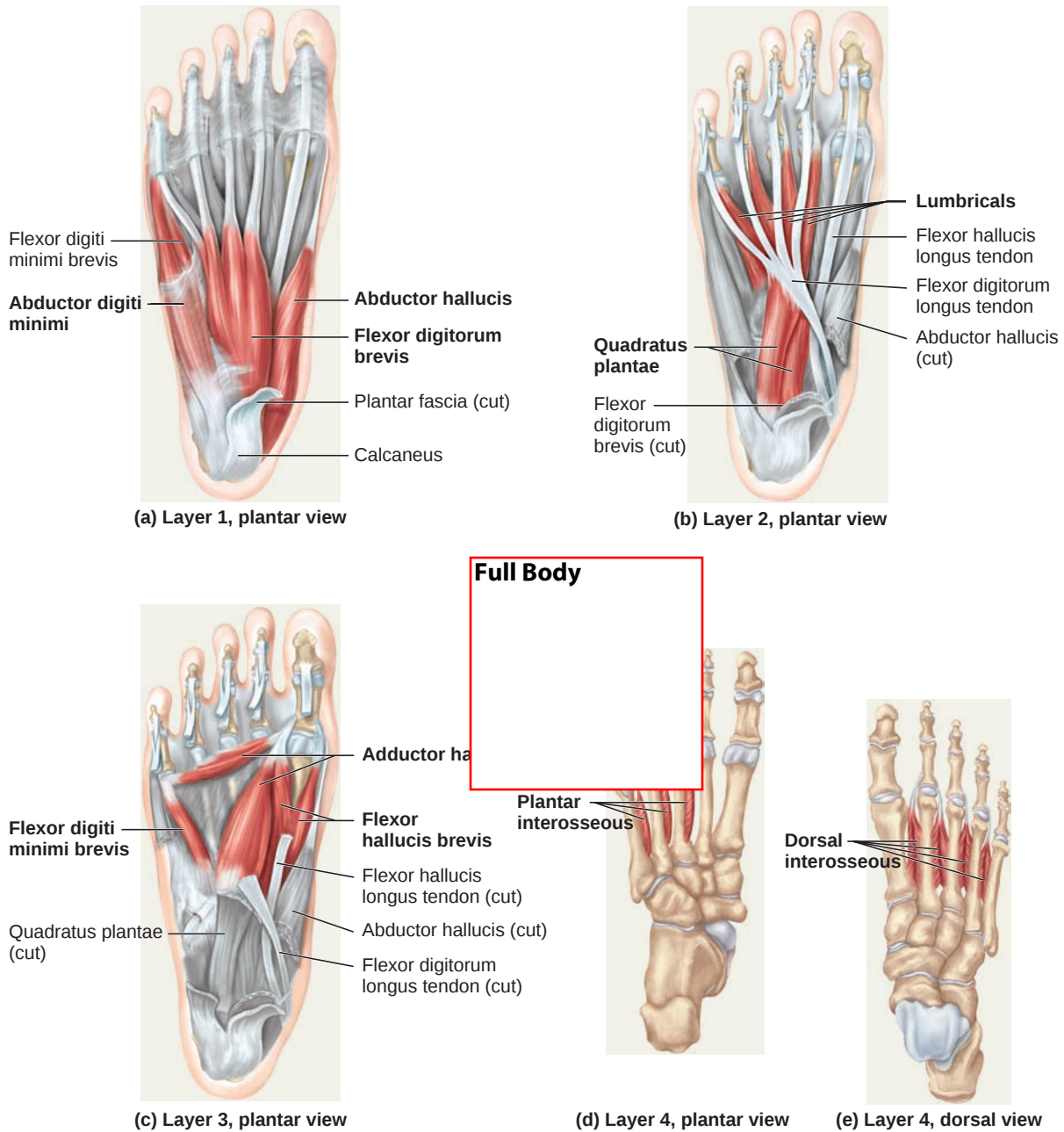


FIGURE A.3 Intrinsic Muscles of the Foot

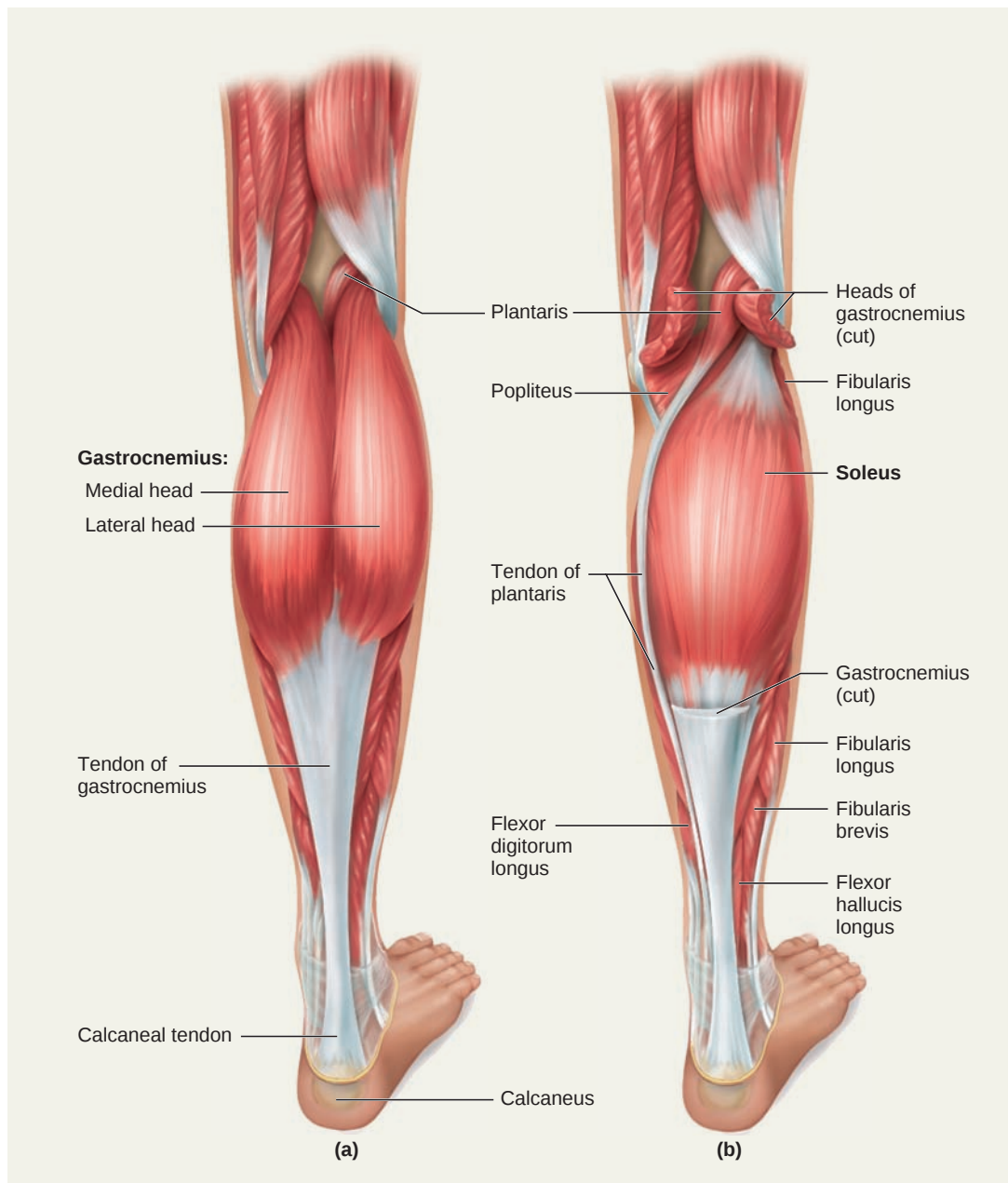


FIGURE A.4 Superficial Muscles of the Leg, Posterior Compartment

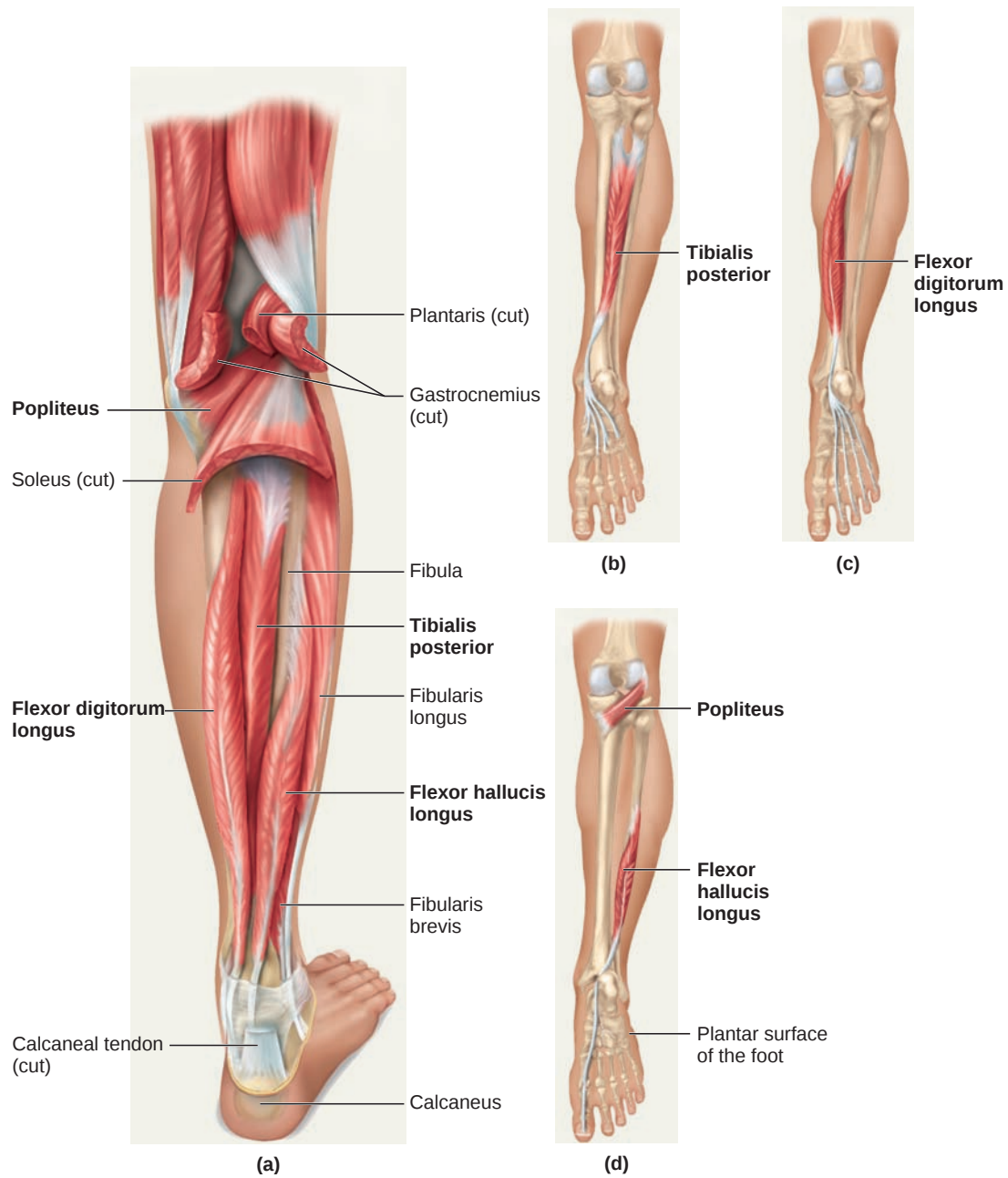


FIGURE A.5 Deep Muscles of the Leg, Posterior and Lateral Compartments

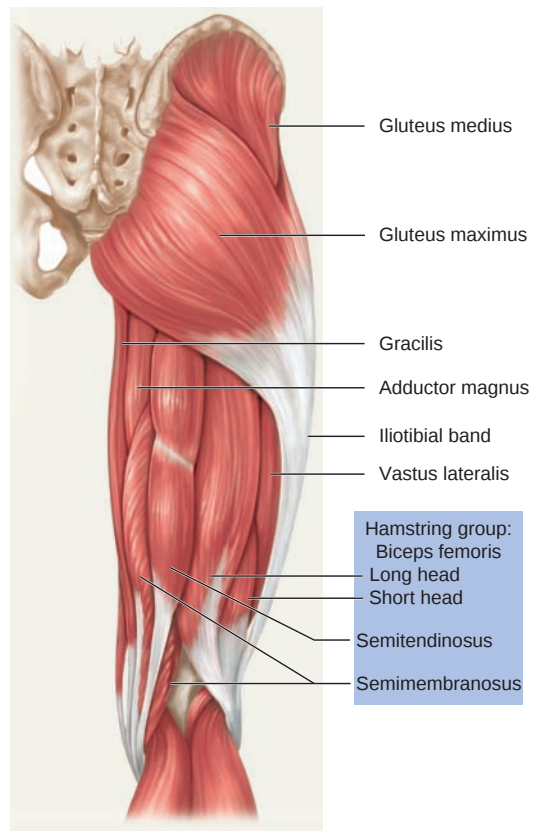


FIGURE A.6 Superficial Gluteal and Thigh Muscles (posterior view)

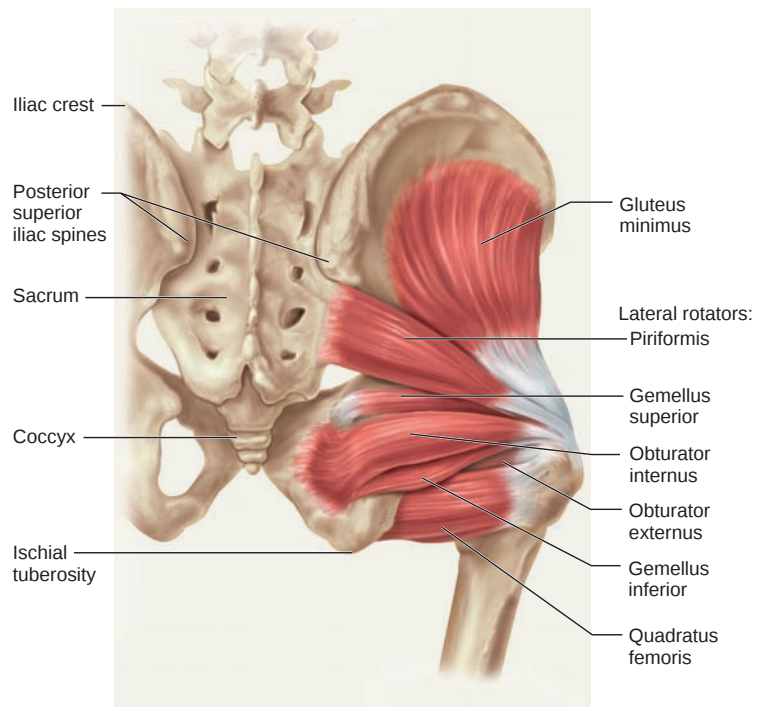


FIGURE A.7 Deep Gluteal Muscles (posterior view)

Anterior Torso Compartment (ATC)

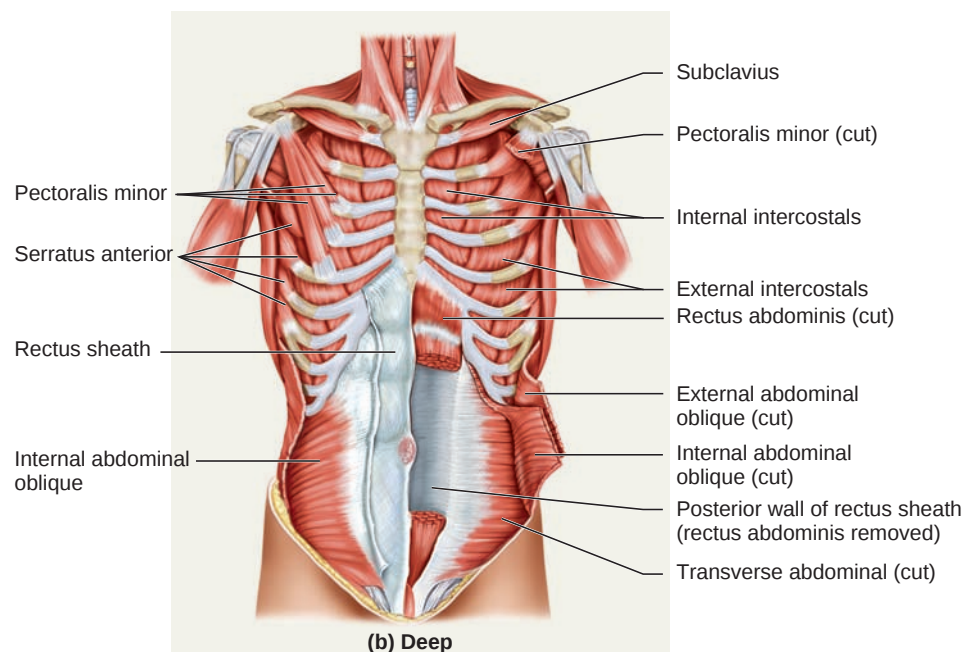
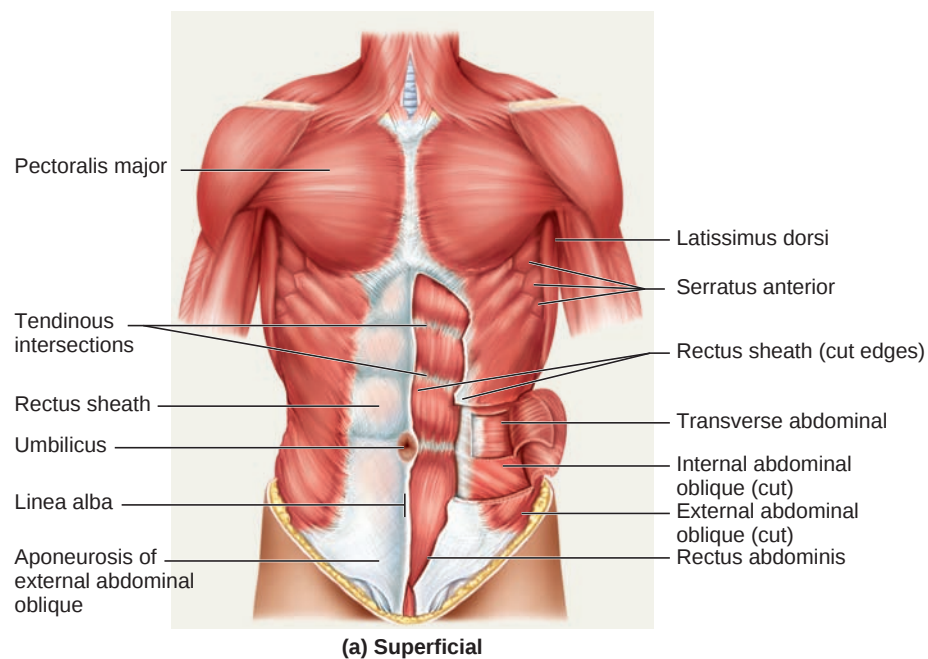
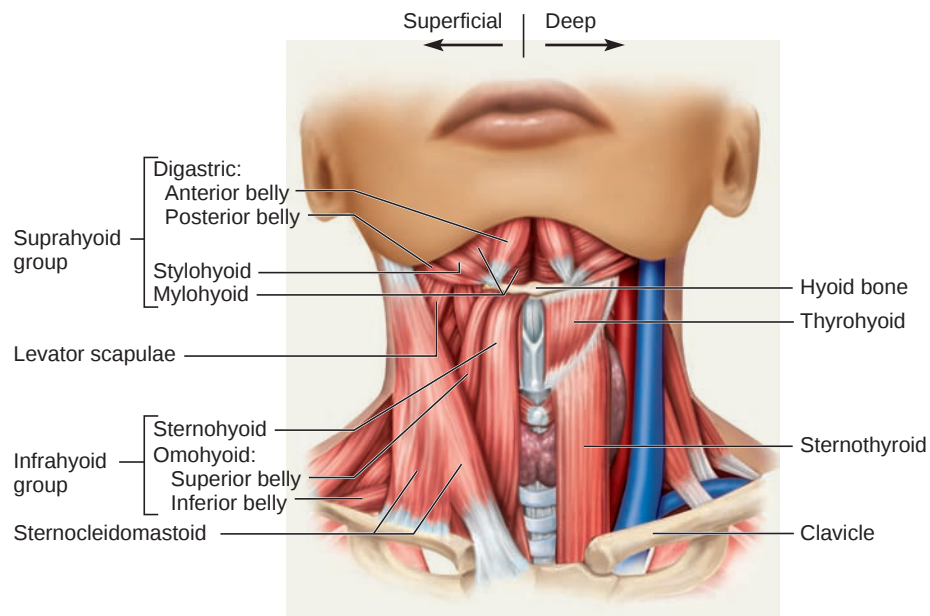
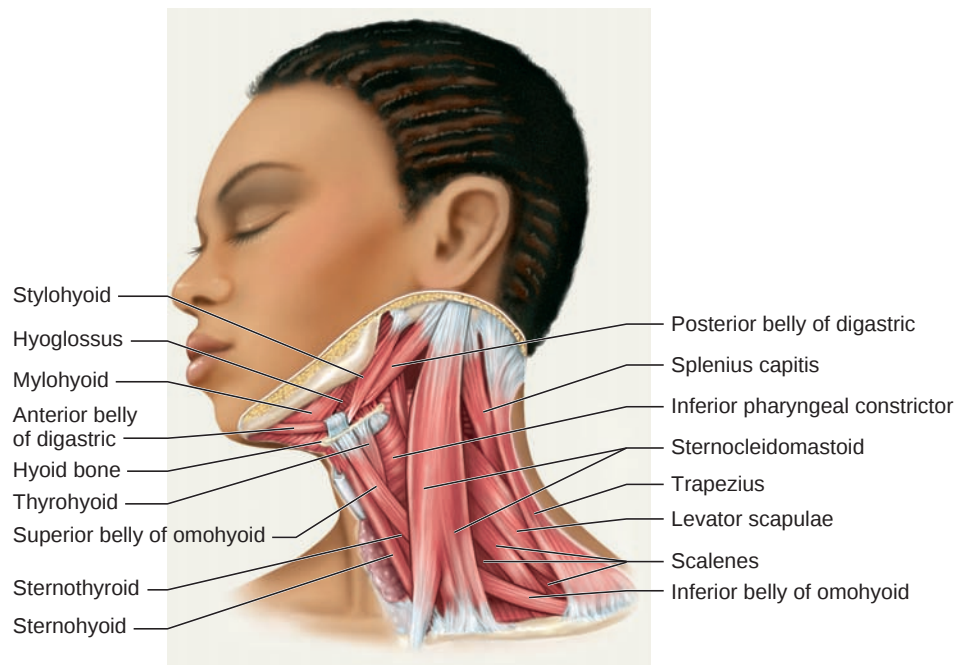


FIGURE A.8 Thoracic and Abdominal Muscles



(a) Anterior view



(b) Lateral view

FIGURE A.9 Muscles of the Neck

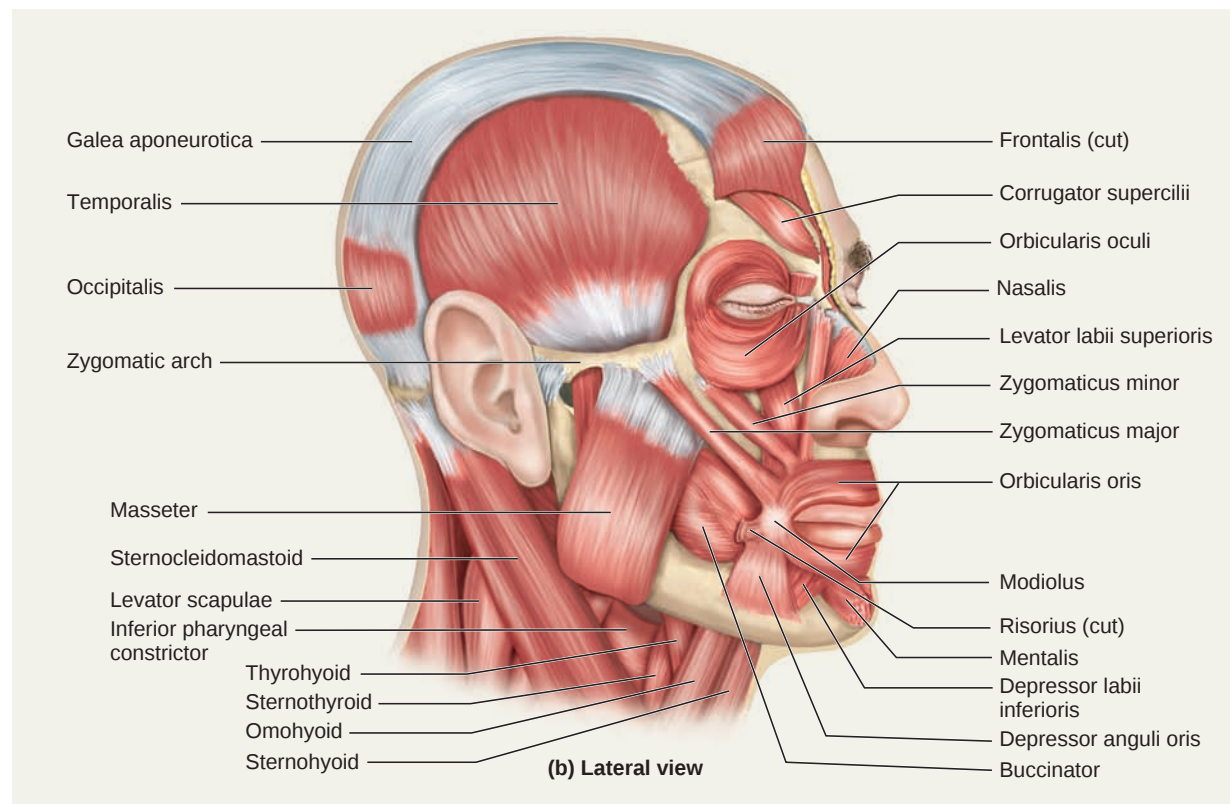
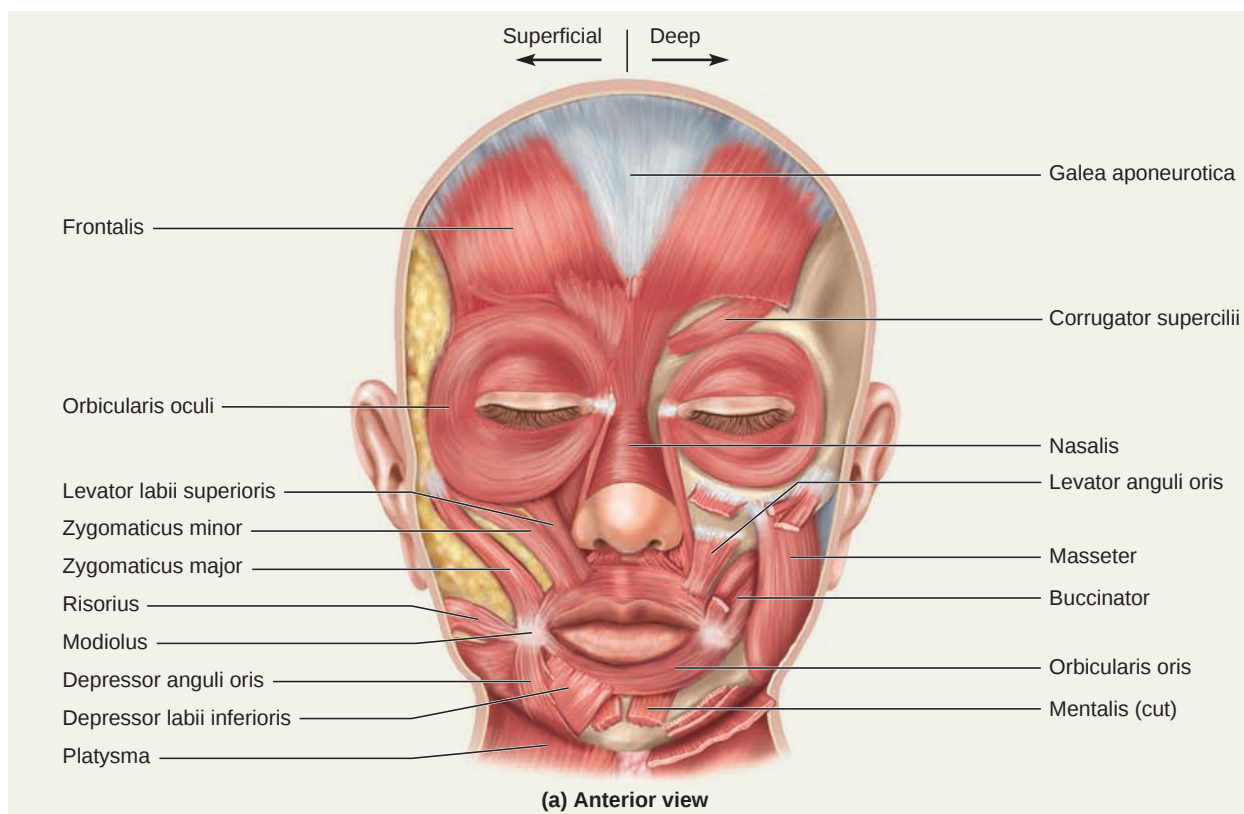


FIGURE A.10 Muscles of Facial Expression

Anterior Lower-Extremity Compartment (ALEC)

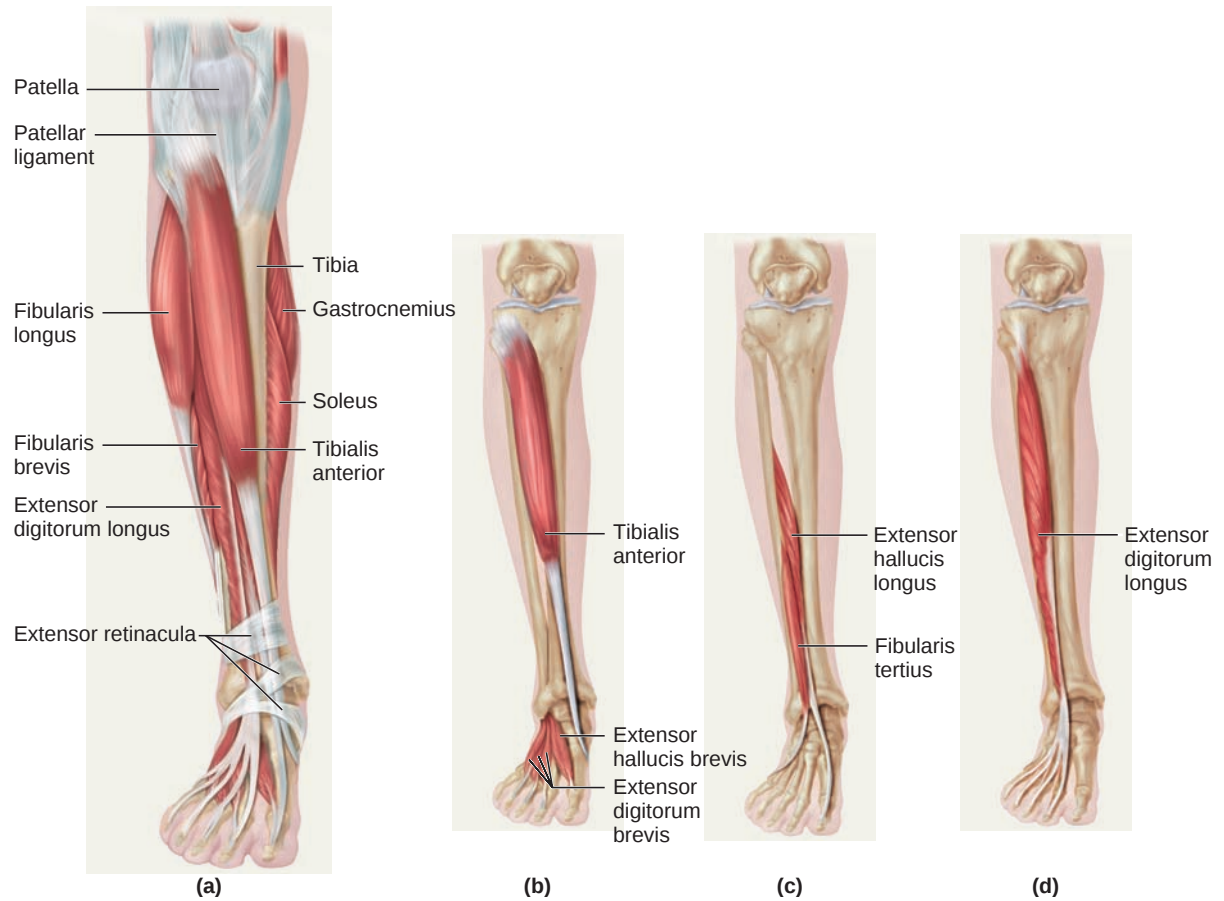


FIGURE A.11 Muscles of the Leg, Anterior Compartment

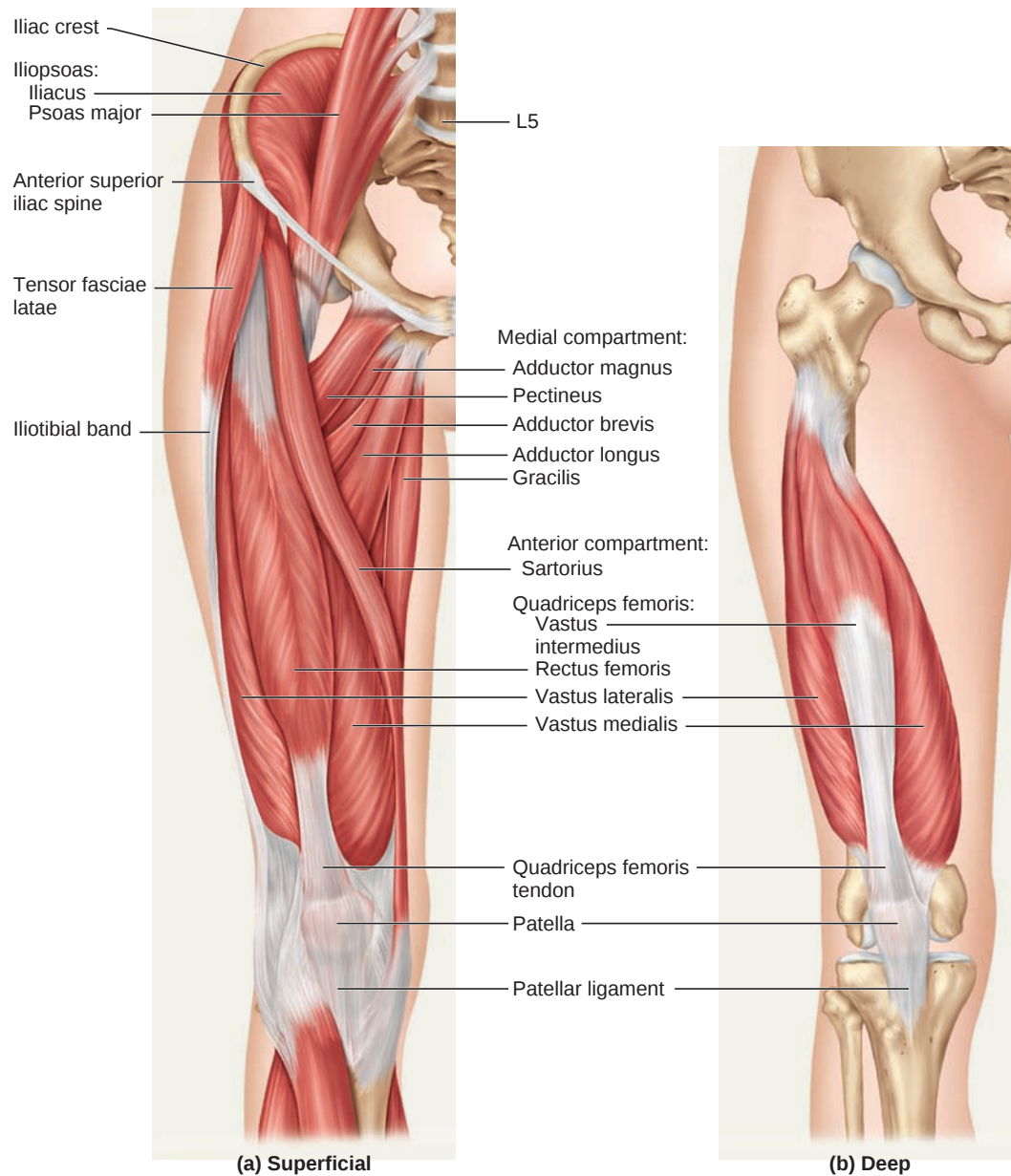


FIGURE A.12 Muscles of the Thigh

Posterior Torso Compartment (PTC)

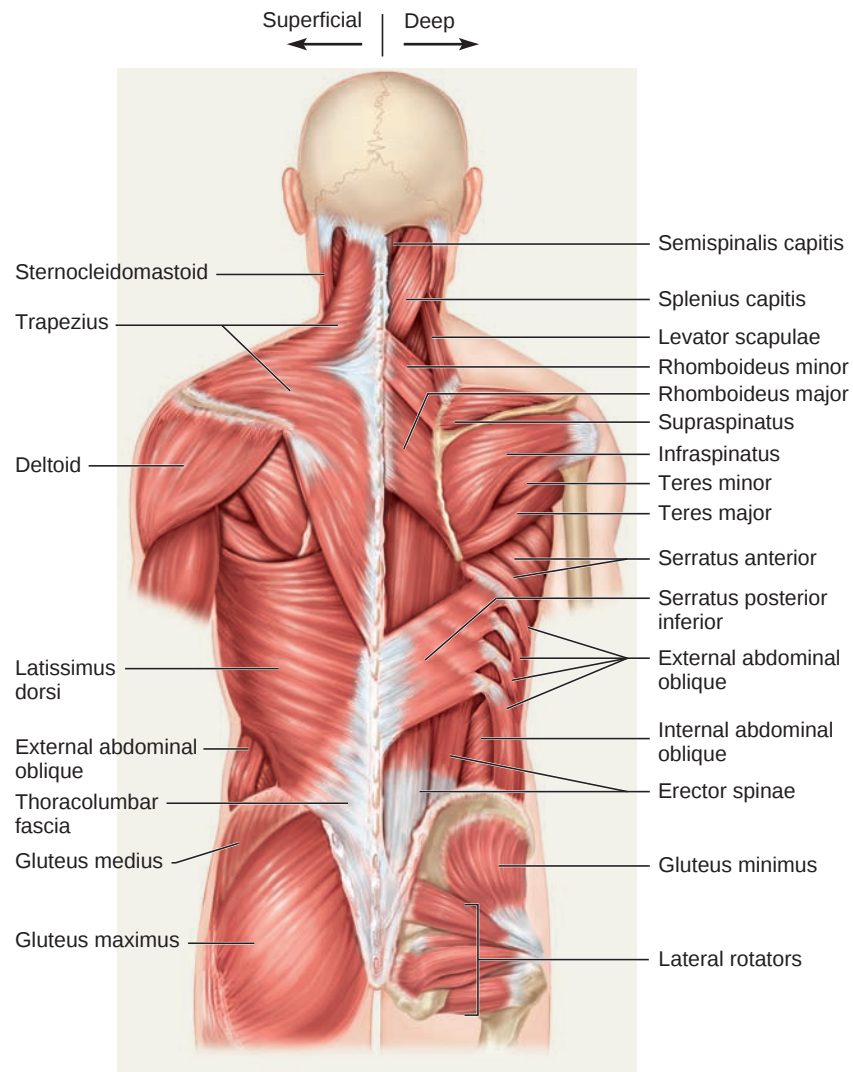


FIGURE A.13 Neck, Back, and Gluteal Muscles

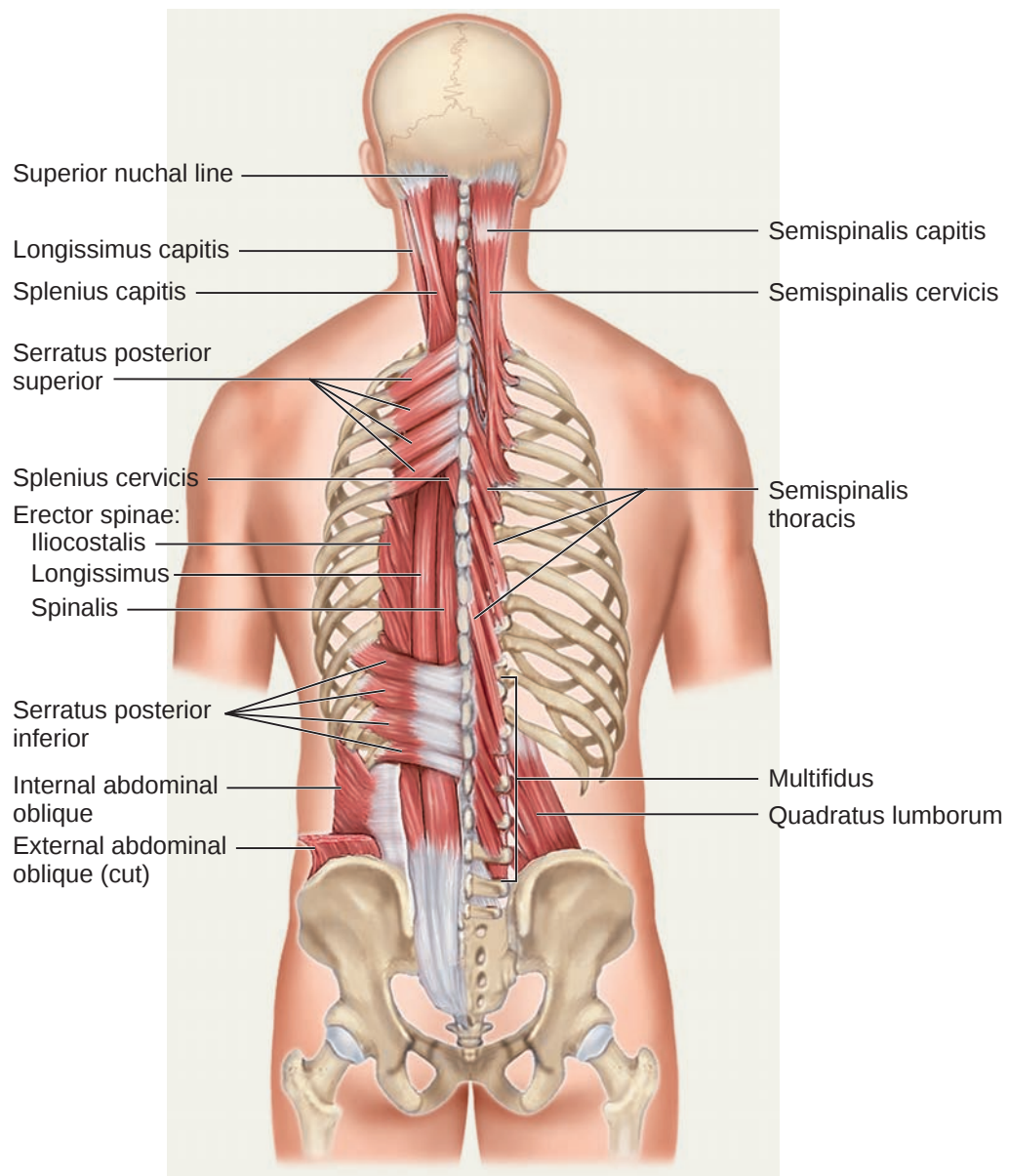


FIGURE A.14 Muscles Acting on the Vertebral Column

Upper-Extremity Compartment (UEC)

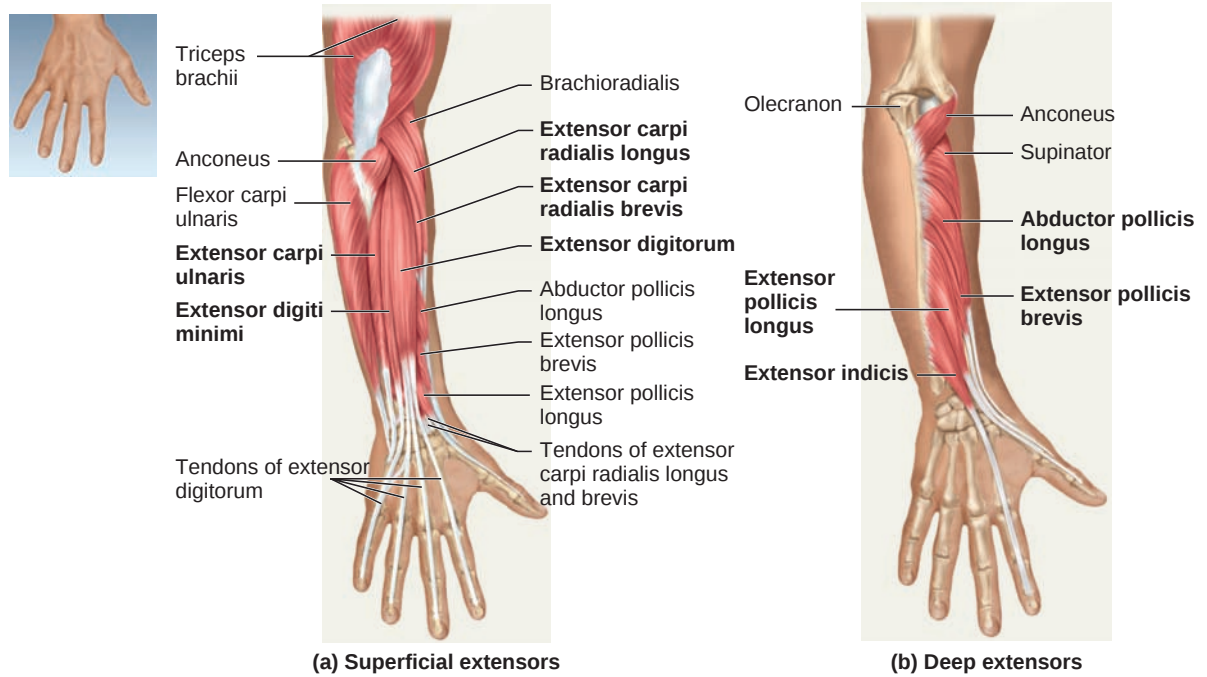


FIGURE A.15 Extensors of the Wrist and Hand

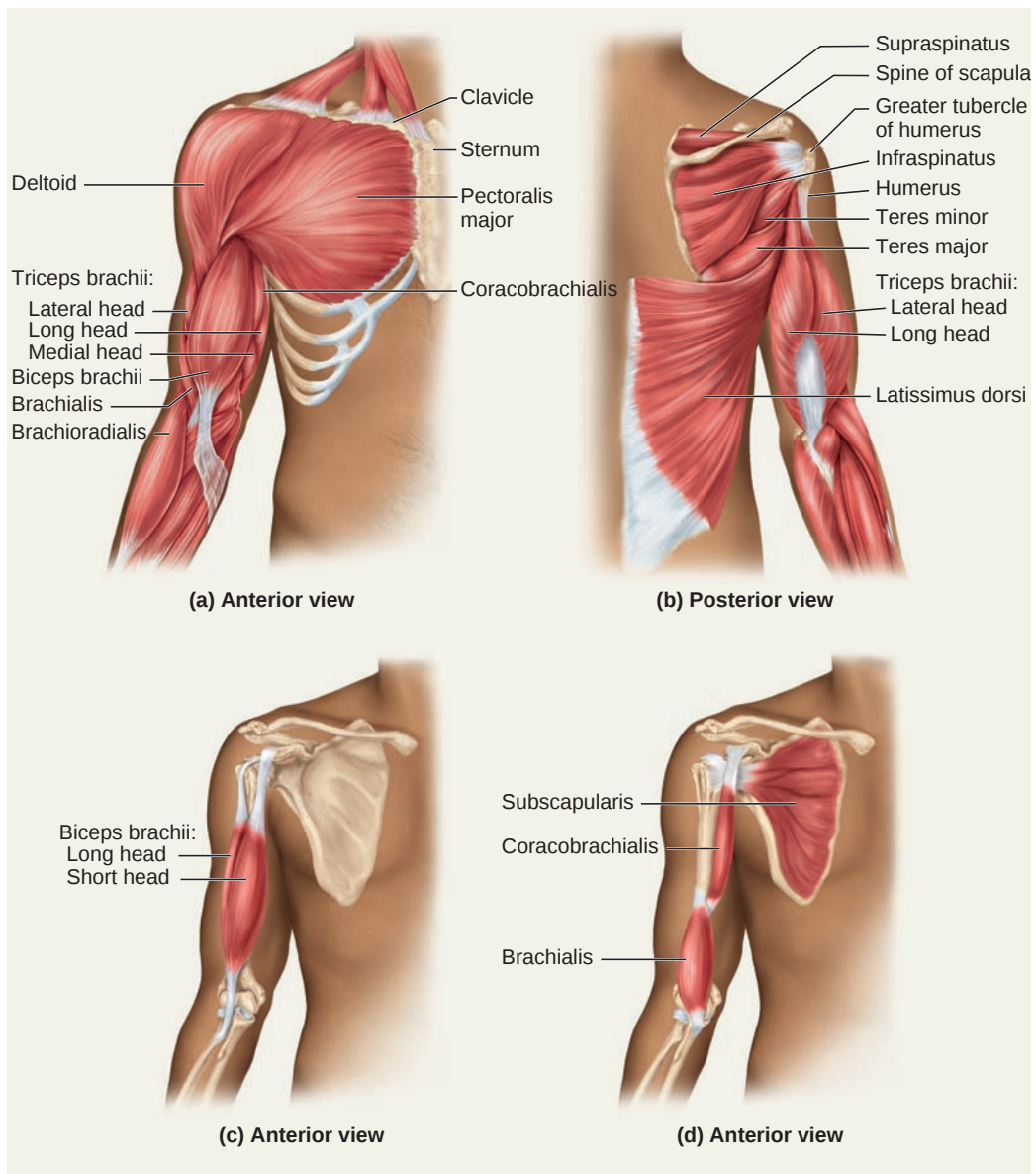


FIGURE A.16 Pectoral and Brachial Muscles

APPENDIX B

RECEPTOR TONUS PRINCIPLES AND NEUROPHYSIOLOGIC LAWS

Receptor Tonus Principles

Ischemia: Lack of blood, oxygen, and nutrients.

Trigger points: Ischemic soft tissues that, when stimulated, refer high neurologic activity into other parts of the body, thus creating secondary pain and dysfunction. See Chapter 5 for more information.

Nerve compression: Pressure on a nerve by an osseous or cartilaginous structure. See Chapter 4 for more information.

Nerve entrapment: Pressure on a nerve by soft tissues.

Postural distortion: Imbalance in the muscular tonus system resulting in movement of the body off the gravitational lines (frontal, sagittal, and transverse planes).

Biomechanical dysfunction: Imbalance in the musculoskeletal system resulting in faulty movement patterns.

Laws of Neurophysiology

Law: A uniform or constant fact or principle.

Law of facilitation (path of least resistance): When an impulse has passed once through a certain set of neurons to the exclusion of others, it will tend to take the same course on future occasions. Each time it traverses the path, the resistance will be less. See Chapter 3 for more information.

Davis's law: If muscle ends are brought closer together, the pull of tonus is increased, thereby shortening the muscle, which may even cause hypertrophy. If muscle ends are separated beyond normal, tonus is lessened or lost, thereby weakening (stressing) the muscle. See Chapter 3 for more information.

Hilton's law: A nerve trunk that supplies a joint also supplies the muscles of the joint and skin over the insertions of such muscles.

Arndt-Schultz law: Weak stimuli activate physiologic processes. Very strong stimuli inhibit them. See Chapter 5 for more information.

Pfluger's Laws

Law of unilaterality: If a mild irritation is applied to one or more sensory nerves, movement will take place usually on one side only—the side that is irritated.

Law of symmetry: If the stimulation is sufficiently increased, motor reaction is manifested not only on the irritated side but also in similar muscles on the opposite side of the body.

Law of intensity: Reflex movements are usually more intense on the side of irritation. At times the movements of the opposite side equal them in intensity, but they are less pronounced.

Law of radiation: If the excitation continues to increase, it is propagated upward and reactions take place through centrifugal nerves coming from the cord segments higher up.

Law of generalization: When the irritation becomes very intense, it is propagated in the medulla oblongata, which becomes a focus from which stimuli radiate to all parts of the cord. This causes a general contraction of all the muscles in the body.

APPENDIX C

AGONIST, SYNERGIST, AND ANTAGONIST

The muscle or portion of muscle that produces the most force during a particular joint movement is known as the **prime mover (agonist)**. The prime movers are generally the deepest muscles of the body. A prime mover spans one joint, providing a stronger muscle action for its specific movement when the muscle first initiates action. The action of a prime mover is very specific; it flexes or extends only the one joint it acts on. The prime movers of the body have the strongest ability to hold the body in and out of postural alignment. They also contribute to most joint restriction that, if left untreated, often limits the joint's range of motion and produces pain on certain movements. To effectively change and decrease muscular imbalances that affect posture and joint restrictions, the prime movers need to be isolated and thoroughly treated. To increase joint range of motion, isolating and releasing the deep primary muscles provides the best results for reducing chronic excessive muscle tension that affects joints and restricts movement.

A **synergist** is a muscle that aids the prime mover; it lies superficial to the deeper primary mover. Since it lies superficial, it crosses multiple joints and therefore has to ration out its strength over more than one joint. However, several synergists functioning together, acting as a functional unit on a single joint, can produce just as much power as that produced by a single primary larger muscle. Synergists assist the prime mover in its action by stabilizing the joint and restricting undesirable movements that would occur if there were only prime movers. They assist in modifying the direction of the joint movement so that the action of the prime mover can deliver all its strength when a contraction is initiated. When a muscle contraction is initiated, a shortening effect occurs, which changes the joint angle; this is also seen with a flexion movement (concentric action). *Flexion* means to decrease the angle between the bones forming a joint.

An **antagonist** muscle opposes the action of a prime mover (agonist). The antagonist opposes the movement at a joint by a controlled lengthening action (eccentric action). When a flexor group (agonist "primary" and synergist "assistors") initiates a flexion movement on one side of the joint, the antagonistic extensor group on the opposing side can relax and relinquish control to the flexor group for the desired and controlled movement. Because it acts on the opposite side of the joint, the antagonist muscle also can control or moderate the speed and range of the agonist to prevent oversteering the joint structure and ligaments by not going beyond the maximal range the joint can achieve.

APPENDIX D

CHIROPRACTIC AND MASSAGE: SYMBIOTIC HEALTH CARE

By Kelly Huber, DC

Chiropractors and massage therapists treat musculoskeletal problems and often work together to reduce a client's pain, correct injury, and educate clients about how to prevent injury. In both chiropractic and massage, professionals emphasize the natural power of the body to heal itself and therefore do not employ the use of drugs or surgery. They also believe that it is more important to prevent disease than to wait for illness to occur. Because the two professions are closely related, they can enjoy a symbiotic relationship for the benefit of the client. But to appreciate this symbiosis, it is necessary to have a basic understanding of chiropractic and how it works to heal the body.

How Chiropractic Works

Chiropractic is a natural method of health care that treats the *cause* of physical problems instead of just the symptoms. It is concerned with the diagnosis, treatment, and prevention of nervous system disorders and general health, and it is based on the philosophy that:

- The body is a self-healing organism.
- The primary cause of musculoskeletal and many other problems in the body is vertebral subluxation.
- Removing subluxation releases the natural power of the body to heal itself.

The simplest definition of *subluxation* is a misalignment of the vertebrae of the spine. The spine houses the spinal cord—the main pathway of the nervous system—and controls movement, feeling, and function throughout the body. All sensory feeling—good and bad, pleasant and painful—emanates from the spinal nerves.

When the spine is in ideal alignment, the nervous system sends messages as they are intended to be sent. In other words, the body functions normally and remains in good health. Muscles and organs are able to do their jobs without pain or restriction.

When vertebrae are misaligned, however, the flow of messages from the brain to all other cells in the body (called *innate intelligence*) is distorted. Instructions can't be received and followed properly because of the misalignments.

To get a better idea of how misalignment affects the nervous system, visualize a garden hose. When the hose is unraveled, water travels through it freely; however, if it becomes kinked, water either trickles through it or stops flowing. Unkink the hose, and the water flows freely again.

Now apply the same concept to the spine and the nervous system: When the spine (the hose) is in alignment, messages from the nervous system (the water) can travel unimpeded; however, when the spine is out of alignment (kinked), those messages become distorted and the body can no longer work optimally. It dysfunctions.

The joints in the spine are designed to move in a certain way. If they are moving properly, the nervous system also functions well. If the joints are not moving properly, the vertebrae and disks start

to experience degenerative changes, which narrow the foramen where the nerves exit, thereby putting pressure on the nervous system.

These misalignments, or dislocations, are a biomechanical malfunctioning that irritates the nerve roots and blood vessels branching off the spinal cord between adjoining vertebrae. The irritation may cause pain and dysfunction in muscles, the lymphatic system, and organ tissues, and it may create imbalance in the normal body processes.

Subluxation occurs in individuals of every age—from infants to the elderly. Infants *can* have subluxations because the birth process can cause trauma to the baby's neck and spine. If these misalignments are not corrected, vertebral subluxation may disturb the spinal cord and nerves, which affect the growth and development of important muscles and organs.

Often, subluxation is the result of common trauma—even *slight* trauma. It is often exacerbated by improper posture, poor breathing habits, sleeping positions, emotional and physical stress, and lack of muscle tone. Unfortunately, subluxation is not always evident to the individual because not all misalignments cause immediate pain.

To check for subluxation, chiropractors sometimes use radiographs (x-rays); magnetic resonance imaging, or MRI (especially standing MRI to see the body's areas of stress); and palpation. All chiropractors palpate (feel) the spine and joints to find subluxations (areas out of alignment) and then manually adjust the vertebrae or joints. An *adjustment* is defined as the specific application of forces to facilitate the body's correction of nerve interference. It is characterized by a specific thrust applied to a vertebra, utilizing parts of the vertebra or extremity bones as levers to directionally correct articular malposition. In other words, an adjustment puts the vertebrae or joint back into alignment and allows the body and nervous system to work freely.

A body in ideal alignment allows the nervous system to send messages as they should be sent; thus, clearing up subluxations also clears up the nervous system.

Chiropractic's Goals

Many people go to a chiropractor only when they experience back, neck, or shoulder pain. But, as stated earlier, subluxation does not always manifest itself in immediate pain. Pain often results only from significant trauma (such as a bad jolt or fall) or after a long period of enduring subluxation and spinal degeneration.

Chiropractors understand the implication of a malfunctioning nervous system and its effects on the total body. Consequently, their goals are not only to correct musculoskeletal dysfunction and subsequently improve range of motion and reduce pain but also to restore normal function to the nervous system.

Nerve interference promotes sickness and disease. When the nervous system does not work properly, the body cannot function properly. Research shows that spinal manipulation can produce significant

neurologic and physiologic effects, including improved range of motion,¹ reduced blood pressure,² slower heart rate,³ and improved pulmonary functioning.

Chiropractic is based on a powerful but simple premise: With a healthy lifestyle and normally functioning nerves, joints, and spine, the body is better able to heal itself.

Doctors of chiropractic are the only health care professionals who are trained in finding and correcting vertebral subluxation. According to a study published in 1998, a chiropractic program of study consists of 4,800 credit-hours. A medical program consists of 4,667 hours, excluding residency.⁴ The same study also showed that chiropractors receive more training in anatomy, physiology, and the musculoskeletal system than do any other physicians. In addition to completing undergraduate studies that generally include the biological sciences, chiropractors study for 3 or more years before receiving a doctorate of chiropractic degree; they then undergo extensive clinical practice to master the analysis, methodology, and skills required to correct subluxations.

Which Should Come First: Massage or Chiropractic?

Do clients benefit more from having a massage before or after a chiropractic adjustment? Although some chiropractors prefer massage before, others recommend it after an adjustment. In the end, it depends on the client.

Most people (possibly up to 75 percent) adjust better after a massage because massage loosens muscle and scar tissue. But in clients who have hypermobile joints (joints that are too loose), the chiropractor can give a better adjustment when the joints are a little tight. This is because it is more difficult to move a joint into position when the joints are loose. Either way, massage is beneficial because it increases blood flow to the area, and this is important since blood carries nutrients to promote healing. Massage also aids in healing injuries, relieves psychological stress, manages pain, improves circulation, improves flexibility, helps mobility, alleviates fibrous adhesions, and reduces swelling and inflammation.

How Chiropractic and Massage Work Together

The body's bone structure supports the muscles. When they work in harmony, the body can heal itself and avoid incurring additional subluxation; however, when muscles are tight, they pull the bone structure out of place. This tightness results from everyday stress, as well as trauma. Even the best adjustments cannot ignore the pull of strong muscles and muscle memory.

¹ Whittingham, W., and Nilsson, N., "Active range of motion in the cervical spine increases after spinal manipulation," *Journal of Manipulative and Physiological Therapeutics*, 24(9).

² Bakris, G., *Journal of Human Hypertension*, March 2, 2007.

³ Zhang, J., Dean, D., Nosco, D., Strathopoulos, D., and Floros, M., "Effect of chiropractic care on heart rate variability and pain in a multisite clinical study," *Journal of Manipulative Physiological Therapeutics*, 29(4) (May 2006): 267–74.

⁴ Coulter, I., Adams, A., Coggan, P., Wilkes, M., and Gonyea, M., "A comparative study of chiropractic and medical education," *Alternative Therapies in Health Medicine*, 4(5) (September 1998): 64–75.

When the muscles are relaxed through massage therapy, the chiropractor can more easily realign the spinal column. Regular massage therapy allows chiropractic adjustment to last longer. Together, chiropractic and massage provide a more complete and effective system of health care.

By relaxing the muscles and breaking up scar tissue, massage therapy also increases the effectiveness of chiropractic care. Massage:

- Aids in preparing the body for chiropractic adjustments.
- Helps relieve pain in muscles and related soft tissues by isolating and releasing the hypertonic muscles that attach to the bones that affect the joints.
- Helps prevent future problems by reducing the excess muscle tension, thereby stabilizing the joints and restoring fluid movement to the joints.⁵

Both modalities are holistic and believe in the innate healing powers of the body. Together, chiropractic and massage facilitate the natural healing process by keeping the body in proper alignment and ensuring a free flow of nerve impulses and circulation of fluids. Chiropractors, like massage therapists, are playing an increasingly important role in health care. The natural affinity between chiropractic and massage is simple: Both professions share similar philosophies and have a synergistic effect on each other. The chiropractic and massage professions are assuming their valuable and appropriate role in the health care system in the United States and around the world.

⁵ Hannon, S., "Objective physiologic changes and associated health benefits of chiropractic adjustments in asymptomatic subjects: A review of the literature," *Journal of Vertebral Subluxation Research*, April 26, 2004.

APPENDIX E

THE MIND-BODY CONNECTION

By Robert J. Rotella, PhD

It's not possible to work in the field of massage and bodywork therapy and not see the intimate connection of the mind and body on a day-to-day basis. Since, in reality, it is impossible to know where the mind ends and the body begins, it is best to view them as a whole.

Since the early 1970s it has been widely accepted in medicine and psychology that attitudes, values, and beliefs, and the emotions attached to them, play an important role in the development of injury and illness. In particular, there has been growing interest in the interactions of the brain, the endocrine system, and the immune system and in their impact on the body as they relate to injury, illness, and perceptions of injury and illness. Since the beginnings of such inquiry, the aesthetic design of rehabilitation centers, as well as the positive attitudes and empathy of staff and caretakers, has been shown to have an impact on the perceptions and emotions of patients and their attitudes about and receptivity toward therapy.

It has been well documented that negative emotions such as hate, fear, panic, rage, despair, depression, and frustration produce strong changes in the body's chemistry, changes that can play a role in bringing forth some types of illness, injury, and disease and, in some cases, intensify the illness and/or pain. There is growing evidence that positive emotions such as joy, love, happiness, purposefulness, pride, and the will to fight may play an especially important role in recovery, the perception of treatment, and receptivity to treatment. Trust and hopefulness seemingly play a crucial role in the willingness of patients to continue rehabilitation activities on their own. Hopelessness and the negative emotions attached to it tend to be counterproductive. Individuals who work with injured or ill patients must pay attention to these psychological states and their impact on the body, as myriad evidence suggests they play a large role in healing.

APPENDIX F

PROPER STAGES OF REHABILITATION OF INJURED SOFT TISSUES

Emergency Care of an Acute Injury

R = Rest allows the nerves and muscles of the body to quiet down.

I = Ice serves as a local anesthetic and vasoconstrictor of the blood vessels, which reduces the bleeding and swelling around the injury site.

Note: To avoid burning or blistering the client's skin, place a paper towel barrier between the ice and skin. Inform the client that the order of sensations he will experience will be cold, burning, aching, and numbness and that the objective is to get to the numbing stage. The ice should be applied for 10 to 20 minutes to provide adequate therapeutic value.

C = Compression interrupts the neurological activity, reducing the muscle spasm.

E = Elevation assists the venous return of blood toward the heart.

Note: It is important to understand that when you are rehabilitating injured soft tissues, certain steps should be followed and a proper order established to ensure the fastest possible recovery without reinjury.

Step 1: Reduce chronic excess nerve and muscle tension (massage/bodywork).

Step 2: Restore resilience, fluid movement, and relaxation (massage/bodywork).

Step 3: Increase flexibility (conscious stretching/yoga).

Step 4: Rebuild strength (weight training/exercise).

Step 5: Increase cardiovascular endurance (aerobic conditioning exercise).

Note: If rehabilitation is attempted without following this order, reinjury and setbacks usually occur. For example, if an injured person attempts weight training before the chronic excess nerve and muscle tension has been substantially reduced from the tissues, the result usually is that the tissues will continue to spasm (often locking shorter) and the facilitated pain patterns will continue and often get worse.

REFERENCES AND RESOURCES

Alter, Michael J., *Science of Flexibility*, 2nd ed., Human Kinetics, 1996.

Anatomica: The Complete Home Medical Reference, Global Book, 2001.

Gray's Anatomy, 38th ed., Churchill Livingstone, 1995.

Guyton, Arthur C., and Hall, John E., *Textbook of Medical Physiology*, 10th ed., Saunders, 2000.

Gylys, Barbara A., *Taber's 20th Edition Cyclopedic Medical Dictionary*, Davis, 2005.

Juhan, Dean, *Job's Body*, expanded ed., Station Hill, 1998.

Khan, K. M., et al., "Time to Abandon the 'Tendinitis' Myth," *British Medical Journal*, vol. 324, March 2002.

Korzybski, Alfred, *Science & Sanity*, 4th ed., Institute of General Semantics, 1958. (Ida P. Rolf, founder of Rolfing, based much of her early work on her study of Korzybski, who was an engineer, linguist, and philosopher.)

LeDoux, Joseph, *The Synaptic Self*, Penguin, 2002, p. 6.

Myers, Tom, *Anatomy Trains: Myofascial Meridians for Manual and Movement Therapists*, Churchill Livingstone, 2002.

Nimmo, Raymond D. C., quoting *The American Illustrated Medical Dictionary*, 21st ed., by W. A. Newman Dorland, Saunders, 1947.

Nimmo, Raymond D. C., "Receptors, Effectors and Tonus—A New Approach," *The Receptor*, vol. 1, no. 1.

Nimmo, Raymond D. C., "Specificity and the Law of Facilitation in the Nervous System," *The Receptor*, vol. 2, no. 1.

Robin, Mel, *A Physiological Handbook for Teachers of Yogasana*, Fenestra, 2002.

Saladin, Kenneth, *Anatomy & Physiology: The Unity of Form and Function*, 4th ed., McGraw-Hill, 2007.

Schuenke, Michael, et al., *Atlas of Anatomy: Head and Neuroanatomy*, Thieme, 2007, pp. 271, 273.

Sobotta, Johannes, et al., *Sobotta Atlas of Human Anatomy*, trans. by Anna N. Taylor, Williams & Wilkins, 1997 (original from University of Michigan; digitized November 27, 2007).

Stedman's Medical Dictionary, 28th ed., Lippincott Williams & Wilkins, 2006.

Travell J. G., Simons, D. G., and Simons, L. S., *Myofascial Pain and Dysfunction: The Trigger Point Manual*, vols. 1 and 2, 2nd ed., Williams & Wilkins, 1999.

CREDITS

ILLUSTRATIONS

From Saladin, *Anatomy & Physiology, The Unit of Form and Function* 5th ed., McGraw-Hill © 2010. Permission granted by The McGraw-Hill Companies:

Chapter 1: Figures 1.1–1.27.

Chapter 2: Figure 2.1.

Chapter 3: Figures 3.1–3.9.

Chapter 4: Figures 4.2–4.4.

Chapter 5: Figures 5.1, 5.2.

Appendix A: Figures A.1–A.16.

Gloria Swanson, medical illustrator, im12change@ameritech.net:

Chapter 6: Figures 6.1–6.4, 6.11–6.16, 6.25, 6.26, 6.30–6.34, 6.40–6.42, 6.51, 6.52, 6.57–6.60, 6.67, 6.68.

Chapter 7: Figures 7.1–7.6, 7.13–7.15, 7.22–7.26, 7.35, 7.36, 7.42, 7.43, 7.50–7.56, 7.69, 7.70, 7.77–7.82.

Chapter 8: Figures 8.1–8.8, 8.15–8.18, 8.25–8.34, 8.44, 8.45, 8.50, 8.51, 8.56–8.60, 8.67, 8.68.

Chapter 9: Figures 9.1, 9.6, 9.7, 9.12, 9.13, 9.24, 9.25, 9.29, 9.30, 9.38–9.41, 9.48, 9.49, 9.59, 9.60, 9.66, 9.67, 9.73, 9.74, 9.78–9.81, 9.90, 9.91, 9.98, 9.99, 9.104, 9.105.

Chapter 10: Figures 10.1–10.6, 10.13, 10.14, 10.17, 10.18, 10.22, 10.23, 10.28–10.33, 10.41–10.46, 10.51–10.53, 10.58, 10.59.

David Scott Lynn (illustrations and text) © 2008, all rights reserved:

Chapter 7: Figures 7.15 a & b.

PHOTOS

Any photos not credited are courtesy of the author. For permission to reuse, contact McGraw-Hill.

Chapter 1: Opener, © Brand X Pictures/RF.

Chapter 2: Opener, © Royalty-Free/CORBIS; Figures 2.1, 2.2, © The McGraw-Hill Companies, Inc./Joe DeGrandis, photographer; Figure 2.3, © Hobby Finn/Photodisc/Getty Images/RF; Figure 2.4, © Peter Holst/Stone/Getty Images/RF; Figure 2.6, © Suza Scalora/Getty Images/RF.

Chapter 3: Opener, © Royalty-Free/CORBIS.

Chapter 4: Opener, © Suza Scalora/Getty Images/RF.

Chapter 5: Opener, © Steve Cole/Getty Images/RF.

Chapter 6: Opener, © Stockbyte/Getty Images/RF.

Chapter 7: Opener, © Suza Scalora/Getty Images/RF.

Chapter 8: Opener, © liquidlibrary/PictureQuest/RF.

Chapter 9: Opener, © Suza Scalora/Getty Images/RF.

Chapter 10: Opener, © Suza Scalora/Getty Images/RF.

Tiffany Manning, www.tiffanymanning.com:

Chapter 6: Figures 6.5–6.10, 6.17–6.24, 6.27–6.29, 6.35–6.39, 6.43–6.50, 6.53–6.56, 6.61–6.66, 6.69–6.76, 6.78–6.87.

Chapter 7: Figures 7.7–7.12, 7.16–7.21, 7.27–7.34, 7.37–7.41, 7.44–7.49, 7.57–7.68, 7.71–7.76, 7.83–7.86, 7.88–7.101.

Chapter 8: Figures 8.9–8.14, 8.19–8.24, 8.35–8.43, 8.46–8.49, 8.52–8.55, 8.61–8.66, 8.69–8.78.

Chapter 9: Figures 9.2–9.5, 9.8–9.11, 9.14–9.23, 9.26–9.37, 9.42–9.47, 9.50–9.58, 9.61–9.65, 9.68–9.72, 9.75–9.77, 9.82–9.89, 9.92–9.97, 9.100–9.103, 9.106–9.114.

Chapter 10: Figures 10.7–10.12, 10.15, 10.16, 10.19–10.21, 10.24–10.27, 10.34–10.40, 10.47–10.50, 10.54–10.57, 10.60–10.71.

GLOSSARY

A

- Abduction** The lateral movement away from the midline of the trunk.
- Achilles tendon** Tendon that connects the calf muscles of the leg to the heel.
- Achilles tendonitis** Inflammation of the Achilles tendon.
- Actin and myosin** The most fundamental units of muscle; cells that are the two primary parts of a muscle fiber and that generate contraction, force, and movement.
- Adduction** The medial movement toward the midline of the trunk.
- Alpha system** The system of nerves that control the extrafusal muscle fibers.
- Ambulation** The act of or action of moving about (walking).
- Antagonist** A muscle that acts in physiologic opposition by contracting.
- Antalgic gait** An awkward manner of walking due to pain.
- Anterior** Viewed from the front.
- Arndt-Schultz principle** Guideline as to how much stimulus causes desired physiologic effects and responses.
- Ascending sensory nerve pathways** Nerves that deliver sensory information to the CNS and brain.

B

- Bone spur** A bony outgrowth.
- Bulging disk** A protrusion of disk material.

C

- Calcaneus bone** The heel bone of the foot.
- Central nervous system (CNS)** Nerves and organs in the brain and spinal cord that control voluntary and involuntary acts. This includes parts of the brain controlling consciousness and mental activities.
- Circular friction** Friction that moves in little circles.
- Circumduction** The circular movements of a limb delineating an arc or describing a cone; a combination of flexion, extension, abduction, and adduction. Also known as *circumflexion*.
- Client** A person who is under the protection of another.
- CNS** See **Central nervous system**.
- Contour** To allow your hand to be soft and form-fitting to the tissue below it.
- Contouring** A technique done with various parts of the hand, such as the palm or the fingertips, and

during several different types of strokes. You can contour your hand during effleurage, petrissage, friction, and so on.

- Contractile** Capable of or producing contraction, the ratcheting and shortening action of a muscle cell.
- Contraction** The action or process of a muscle becoming smaller and shorter.
- Coronal plane** The plane that separates the body into anterior and posterior (front and back) sides. Also referred to as the *frontal plane*.
- Cranial nerve** A nerve emerging from the brain, bypassing the CNS.
- Cross-fiber friction** Friction that is going against the grain of the muscle fibers.
- Cross-linking** The pattern formed when tissues create scarring.

D

- Davis's law** A principle which holds that if muscle ends are brought closer together, the pull of tonus is increased, thereby shortening the muscle, which may even cause hypertrophy. If muscle ends are separated beyond normal, tonus is lessened or lost, thereby weakening (stressing) the muscle.
- Deep intrinsic muscles** Muscles situated within or belonging solely to the organ or body part.
- Degenerative process** A process of thinning and deteriorating.
- Dehydration** Loss of water in the body.
- Descending motor nerve pathways** Nerves that deliver commands from the brain and CNS to the muscles and organs, instructing them to turn on or off.
- Descending sensory nerve pathways** Nerves that block incoming sensation.
- Deviation** A noticeable difference from the average or normal range.
- Discrepancy** The state of being different.
- Disk compression** The squeezing or compressing of a disk by force.
- Dissociate** To disconnect from or become unconscious of a sensation or event.
- Distal** The end of a bone, farthest from the trunk.
- Dorsal** Belonging to or situated near or on the back.
- Dorsiflex** To flex in a dorsal direction.
- Dorsiflexion** The flexion movement of the ankle resulting in the top of the foot moving toward the anterior tibia bone.
- Dysfunction** The abnormal functioning of a body part

E

Edge The ideal limit of a manual pressure technique, stretch, or exercise; the point just before pain, fear, or resistance

Edge technique The manual technique that uses the edge as a guideline.

Effleurage A long gliding stroke, usually applied with the palm and/or heel of the hand, knuckles, and/or fingertips.

Electromyographic (EMG) Pertaining to equipment used to measure electrical activity in the nerves.

Engram The memory pattern associated with actions and trauma.

Eversion The turning of the sole of the foot outward or laterally.

Exacerbate To cause a disease or its symptoms to become more severe.

Excitation The initiation of nerve activity in a nerve, resulting in excitation in muscles and organs.

Extensibility The ability to lengthen without tearing or damage.

Extension The act of straightening that results in an increase of the angle in a joint by moving bones apart.

External rotation The rotary movement around the longitudinal axis of a bone away from the midline of the body. Also known as *lateral rotation* and *outward rotation*.

Extrafusal The type of muscle fiber that generates the most action, power, and work.

F

Facet joint An articulation connecting each vertebra with the vertebra directly above and below it and designed to allow the vertebral bodies to rotate with respect to each other.

Facilitation The activation of a nerve fiber with enough intensity to modify the synapse, toward being more able to conduct more nerve charge.

Fasciae The connective tissues of the body, of varying density, such as tendons, ligaments, and the casings of the muscles.

Fitness The state of having strength, endurance, and healthy cardiovascular function.

Flat feet A condition characterized by fallen arches.

Flexibility The quality or state of being flexible.

Flexible The ability to be bent, turned, or twisted without being broken.

Flexion The act of bending that results in the decrease of the angle in a joint by bringing bones together.

Fragmented disk A disk with material broken off.

Friction A short (1 inch or so) stroke that treats the tissue under the skin.

Frontal plane The plane that separates the body into anterior and posterior (front and back) sides. Also referred to as the *coronal plane*.

G

Gamma system The system of nerves that control the intrafusal muscle fibers.

Glide A stroke that moves over the skin, deep or superficial.

Golgi tendon organs Nerve receptors that measure levels of muscular pull.

H

Health Full and proper function of the systems of the body.

Herniation Pressure on a spinal disk sufficient to break down the tissues.

Horizontal plane The plane that separates the body into two levels: the superior (upper) and the inferior (lower). Also known as *transverse plane*.

Hormesis The principle that low doses of a negative substance stimulate immunity.

Hyaluronic acid A chemical that holds water in place.

Hypercontracted The term used in reference to an excessively tight contraction.

Hypermobility Abnormal or excessive movement.

Hypertonic Characterized by excessive tone.

Hypertonicity The quality or state of being hypertonic.

Hypomobility Abnormal deficiency of movement.

I

Iliotibial band A downward continuation of the fascia lata that resembles a tendon and is inserted into the lateral tuberosity of the tibia.

Inflammation A local response to cellular injury in which the body reacts to infection, irritation, or other injury, the key features, being redness, warmth, swelling, and pain.

Inhibition The slowing or stopping of something, such as nerve tonus.

Inhibitory Pertaining to the ability to turn down or off.

Intermuscular septum A double-layered sheet of connective tissue that divides muscle compartments.

Internal rotation The rotary movement around the longitudinal axis of a bone toward the midline of the body. Also known as *medial rotation* and *inward rotation*.

Interneurons The vast multitude of tiny neurons and synapses between nerve trunks that provides a nearly infinite range of modification and variation of the basic nerve signals.

Intrafusal The type of muscle fiber containing sensory nerves measuring the activity of the extrafusal fibers and the muscle as a whole.

Inversion The turning of the sole of the foot inward or medially.

Isolate To define the borders of something, separating it from others.

K

Kinetic chain An automatic response that compensates for deficiencies originating elsewhere in the musculoskeletal body.

Kyphosis Rearward curvature of the spine.

L

Lamina The part of the neural arch of a vertebra extending from the pedicle to the median line.

Langer lines Lines of tension in the skin's elastic component due to the alignment of the collagen fibers in the dermis; frequently used in surgical procedures as a guide for cutting.

Lateral A term relating to the outside.

Ligament laxity Slackness or looseness in a ligament.

Localized A term applied to symptoms that are very close to their cause.

Locomotion The act or power of moving from place to place.

Longitudinal fascia Fascia that runs lengthwise, creating stability and strength.

Lumbosacral junction The site at which the lumbar and sacral regions join.

M

Mechanical overload A property that involves a relationship between stress and a reaction to an applied force.

Medial Relating to the inside or toward the midline.

Meissner corpuscles (quick) Responding nerve receptors of the skin.

Merkel receptors (slow) Responding nerve receptors of the skin.

Metatarsal joints The joints between metatarsal bones.

Metatarsal phalangeal joints The joints between metatarsals and phalanges.

Midsagittal plane The plane that separates the body into left and right sides.

Moving compression Compression in which the therapist's hand (or elbow) is applying slow, deep pressure while the body part beneath the hand is moving.

Muscle stripping A gliding action along a muscle from the beginning to the end. This is a very slow technique, with the motion being about 3 inches per 10 seconds.

Muscular division An individual muscle, or a group of muscles that share a common compartment, that separates divisions by intermuscular septa.

Myofascial continuity The direction the fascia flows.

Myosin See **Actin and myosin**.

N

Nerve compression The compression of nerves by bone or cartilage.

Neuromuscular junction The nexus between the brain and nerves and the action-generating or symptomatic structures of the body: the muscles, connective tissues, and organs.

O

Origin The primary source; the more fixed, central, or larger attachment or part of a muscle.

Orthotic corrections Corrective treatments to straighten.

P

Pacinian corpuscles Nerve receptors embedded deep in the skin and periosteum that are activated by slow, steady pressure and stretching.

Parasympathetic The portion of the nervous system responsible for healing and regeneration.

Periosteum A dense fibrous membrane covering the surface of bones and serving as an attachment for tendons and muscles.

Peripheral varicosities Abnormal swellings of the veins, located at or near the surface.

Perpetuate To cause or last indefinitely.

Petrissage/kneading A series of gliding alternating pressures employing the picking up and/or kneading of the skin and muscle tissues.

Picking up Grasping the belly of a muscle between the thumb and fingers.

Plantar aponeurosis Dense bands of fibrous connective tissue that cover and attach the toes to the calcaneus bone; also called the *plantar fascia*.

Plantar fasciitis Inflammation of dense fibrous connective tissue located around the sole of the foot that binds the deeper structures together.

Plantar flexion The extension movement of the ankle resulting in the foot and toes moving away from the body.

Plantar surface of foot The sole of the foot.

Positional terms The universal points of reference that describe the position of one body structure as it relates to another.

Posterior Viewed from the back.

Primary muscle A muscle that is first in order of importance.

Pronation The internal rotation of the radius so that it lies diagonally across the ulna, resulting in the palm-down position of the forearm.

Propulsion The action of moving forward or ahead.

Proximal The beginning of a bone, closest to the trunk.

Pseudo Not genuine, false, deceptive, or not the real thing.

R

Radiation The process in which pressure on the body causes sensation to fan out from the point of the pressure.

Referral Sensation that is felt in a different, sometimes distant, bodily location from the one at which pressure is applied.

Reflexive release Automatic relaxation.

Relax (1) To stop neuromuscular tension. (2) To soften tissues or substances, usually by reducing the strain placed on them.

Renshaw's cells Spinal interneurons that inhibit peripheral activity.

Resting tonus The chronically accumulated levels of tonus (nerve charge) in a neuromuscular unit.

Reticular formation The unconscious area of the brain controlling overall body tonus.

Rocking A stroke that gently "bounces" the body back and forth.

Ruffini corpuscles Receptors deep in the skin that perceive muscle movement.

S

Sagittal plane The plane that separates the body into left and right sides.

Scoliosis Lateral (sideways) curvature of the spine.

Segmental facilitation A theory which states that irritation to a somatic (neuromuscular system) nerve subsequently reflexes into its respective spinal cord level and consequently excites the visceral (organ and gland) nerves attached to the same level, often

leading to chronic irritation of the related organ systems.

Sinuses Small openings or cavities.

Soft tissue The muscle and connective tissue of the body.

Somatic Pertaining to the neuromuscular system.

Spatial Pertaining to space.

Sprain An injury to a joint or ligament that is caused by sudden and violent twisting and is marked by weakening, swelling, and inflammation of the site.

Static compression Pressure on a muscle that is exerted constantly and without motion.

Stimulus Something that increases neurologic activity.

Strain An injury resulting from a wrench or twist and involving overstretching of muscles.

Stressor Any physical or mental force, internal or external, that stimulates the physical body to the point of a reaction that causes a change in the state of the body.

Stretch reflex The contraction of a muscle in response to quick pressure on its tendon.

Structural homeostasis (1) The body's process of returning to its normal state. (2) The tendency of the musculoskeletal system to always move toward balance.

Subluxation Misalignment or dislocation of spinal vertebrae.

Subtalar A joint connecting the talus and tarsal bones.

Summation The repetition or convergence of nerve signals on a synapse.

Superficial Pertaining to the surface.

Supination The external rotation of the radius so that it lies parallel to the ulna, resulting in the palm-up position of the forearm.

Synapses The junction across which a nerve impulse passes from an axon terminal to a neuron, muscle cell, or gland cell.

T

Temporal Pertaining to time.

Tendonitis Inflammation of a tendon.

Tension (1) Tautness or contraction. (2) The balance between two forces. (3) Stress from elongation, chemical or electrical. When the biochemical or electrical charge from the central nervous system persistently remains in an active state (chronically excited), the muscle remains in the

activated (chronically contracted) state—therefore, tension in the muscle.

Tension overload A momentary state of increased stress.

Thixotropic The ability of fascial molecules to bond, causing “stickiness.”

Tibial talar The joint connecting the tibia and talus bones of the ankle.

Tone The slight level of contraction in a muscle, which requires a neuromuscular charge to be achieved.

Tonus The state of partial contraction that is characteristic of a normal muscle. It is maintained, at least in part, by a continuous bombardment of motor impulses originating reflexively, and it serves to maintain body posture and to hold the musculature in a state of readiness for specific demands.

Tonus system A complex neural network of neurons that monitor and alert the forebrain to information coming from specific regions of the peripheral nervous system. Discrete groups of neurons (called *nuclei*) monitor the state of the body and function in such processes as arousal, sleep, wakefulness, and muscle tone. The tonus system facilitates responses to incoming stimuli. Also known as the *reticular system*.

Traction The technique of pulling on a limb or part of the body. This is done with a continuous sustained force.

Transverse plane The plane that separates the body into two levels: the superior (upper) and the inferior (lower). Also known as *horizontal plane*.

Trigger finger A finger that the joint locks in either the straight or the bent position.

Trigger point A small area of ischemic soft tissue that, when stimulated, refers high neurologic activity into other parts of the body, thus creating secondary pain and dysfunction.

V

Vagus nerve A cranial nerve traveling to most of the viscera.

Vigorous Exhibiting strength and active force.

Visceral Pertaining to organs and glands.

Volitional release Relaxation caused by the client's consciously releasing his or her grip.

W

Withdrawal reflex The pulling away of the body in response to painful or intrusive input.

INDEX

See also specific muscles in the separate Muscle Index

A

abdominal area, postoperative scar tissue in, 171–172
abdominal muscles, 167–173, 352
lengthening of, 49, 165, 171, 176, 213
shortening of, 2, 39, 44, 46, 50, 74, 77, 165, 178, 199
treatment of, 172–173
abdominal pain, 170–171
abductors, stretching of, 249
acetabulum (hip sockets), 25
Achilles tendon, 130–131
acromioclavicular joint, 19, 20, 282
actin, 60–62, 70, 72, 84, 94, 116
active movement, assessment using, 48
adaptations. *See* compensations
adductor group, 245–249
treatment of, 249–250, 253
adhesive capsulitis, 289
adjustment, chiropractic, 364
aging, resting tonus and, 92
agonist (prime mover) muscle, 362
AIIS (anterior inferior iliac spines), 24, 237
ALEC. *See* anterior lower-extremity compartment
all-or-none theory, 74
alpha nerve system, 72, 102–103
alveolus (bone), 11, 12
anatomical position, 34
anesthesia, effect on fascia, 94
ankle bones, 27–28
ankle injuries, 219, 230
ankle muscles, 225, 230
ankle pain, 138, 151
antagonist muscle, 362
anterior inferior iliac spines (AIIS), 24, 237
anterior lower-extremity compartment (ALEC), 218–256, 355–356
case study, 219–220
foot, 221, 355
hip, 240–251, 356
leg, 222–231, 355
stretching exercises, 252–254
thigh, 232–239, 356
treatment of, 226–227
anterior superior iliac spines (ASIS), 24
as landmarks, 35, 47, 142
anterior torso compartment (ATC), 164–217, 351–354
abdominals, 167–173, 352
case study, 166
cervical muscles (*See* cervical muscles)
iliopsoas (*See* iliopsoas muscles)
pectorals and subclavius, 181–187, 352, 360
scalenes, 203–206, 312, 317
serratus anterior, 187–189, 352
stretching exercises, 213–215
temporomandibular joint (*See* temporomandibular joint)
anterior view, 35–36
aponeurosis, 261, 270
appendicular division, 10–11
arched posture, 51–53, 258, 261, 282
arm bones, 20–22

arm muscles. *See* upper-extremity compartment
arm pain
anterior torso compartment and, 182–183, 188, 204
posterior torso compartment and, 270, 278, 288, 292–293
upper-extremity compartment and, 312–313, 316–317, 319, 321, 326–328, 332–333, 336–337
Arndt-Schultz principle, 109–110, 361
arthritis
pseudo-, 85
wrist and hand, 317
articulations (joints), 12, 28–29. *See also specific joint*
ascending sensory nerve pathways, 113
ASIS (anterior superior iliac spines), 24
as landmarks, 35, 47, 142
ATC. *See* anterior torso compartment
atlantoaxial joint, 15, 17
atlanto-occipital joint, 15, 39
atlas, 15, 17
axial division, 10–11
axis, 15, 17

B

back muscles. *See* posterior torso compartment
back pain
anterior torso compartment and, 165–166, 177–178
lower-, 151, 156, 251, 267
posterior torso compartment and, 259–261, 264, 266–267, 270, 277, 281, 285, 288
balance, 92–93
bilateral symmetry, 35, 37
biochemical tension, 62, 67–69, 72, 77, 115
biomechanical dysfunction, 361
blood vessels, compression of, 87
body ball, stretching exercises using, 213–215
body planes of reference, 35
body water, 84
bones, 10–11. *See also specific bone*
during postural assessment, 35–36, 44
tension in, 62–64
bone spurs, in heel, 131
bony landmarks, 11–12. *See also specific landmark*
in postural assessment, 36–37, 47
brachial nerves, 289, 312
brain, 102–104, 113
brainstem, 103, 106
breastbone (sternum), 18–20, 29
breast pain, 184
breathing, dissolving tensions using, 49
bunions, 225
buttocks, 146, 148–150, 351, 357
pain in, 146, 147, 149–151, 156, 266–267
stretching of, 159–160
treatment of, 147–148, 151–152

C

calcaneus (heel bone), 27–28, 125, 130, 225
calf muscles, 127–133, 158

calf pain, 128–131, 151
canal (of bone), 12
capitate, 22–23
capitulum (humerus), 22
“cardiac arrhythmia” trigger points, 184
carpal bones, 22–23
carpal tunnel syndrome, 293, 317, 320
cartilage, 28–29
costal, 18–20, 29
thyroid, 195–196, 199
cartilaginous joints, 28–29
case studies
anterior lower-extremity compartment, 219–220
anterior torso compartment, 166
posterior lower-extremity compartment, 122
posterior torso compartment, 259
upper-extremity compartment, 313
C-curved scoliosis, 53–54
CEM&NT (cumulative amount of chronic, excess muscle and nerve tension), 2, 4–5, 40, 312
central nervous system (CNS), 4–5, 61, 65, 89, 106, 113
central position, 44–45
cerebral cortex, 102–104, 113
cerebrum, 103, 104
cervical curvature, 16, 48
flattening and tilting of, 90, 205, 282, 296
cervical muscles, 190–202
anterior, 194–202, 353
deep, 197–199, 353
superficial, 194–197, 353
treatment of, 200–202
pain in (*See* neck pain)
posterior, 282, 285–286, 294–296, 298–299, 357–358
stretching of, 306
treatment of, 296–298
scalenes, 203–206, 312, 317
treatment of, 192–193, 213–215, 296–301
cervical vertebrae, 15, 17
compression of, 39, 165–166, 184, 204–205, 312
flexion of, 204
charting, 46
chemical modification of synapses, 62, 67–69, 72, 77, 115
chest muscles, 181–189
chest pain, 182, 184, 188
chiropractic, 363–366
chronic nerve excitation, 61–62
chronic neuromuscular tension, 4, 61, 67–73
clavicles (collarbones), 18–20, 29
retraction of, 87
client education, 40, 48–49, 101, 108, 111
client expectations, 41
client interaction, 40–49
client interview, 40–42
client positioning, during table assessment, 47
client self-awareness
of edge, 112
of muscle tension, 40, 45, 46, 48–49, 101–102
reclaiming, 113–114, 116

client's file, 46
 client-therapist relationship, 2, 48
 client to therapist communication, 112–114
 CNS (central nervous system), 4–5, 61, 65, 89, 106, 113
 coccyx (tailbone), 15–16, 147
 collarbones (clavicles), 18–20, 29
 retraction of, 87
 compensations, 37–39
 maintaining eye level, 54, 90, 171, 184, 199, 303
 in scoliosis, 54, 178, 267
 concave angles, 48
 conditioned reflexes, 76, 99
 condyle, 11–12
 fibular, 26–27
 connective tissue, 63, 94. *See also specific type of tissue*
 conscious control
 over muscle fibers, 72
 reclaiming, 114
 consciousness, 104
 conscious sensation, sources of, 106–107
 constant relative pressure, 108
 coordination, 92–93
 coracoid process (scapula), 329
 coronal plane, 35
 costal cartilage, 18–20, 29
 cranial nerve X (vagus nerve) irritation, 87
 crest, 11–12
 cross-body relationships, 86
 cross-linking, 84
 cuboid bone, 27–28
 cumulative amount of chronic, excess muscle and nerve tension (CEM&NT), 2, 4–5, 40, 312
 cuneiform bones, 27–28

D
 Davis's law, 39, 50, 73–74, 77, 361
 deep, 36
 deeper, 112
 deep paraspinal muscles, 263–265
 deep posterior compartment, 135–139, 350
 dehydration, 84, 94
 dens (odontoid process), 15
 depressions (of bones), 12
 descending nerve pathways, 113
 desensitization, 78–79, 98–99, 101, 113
 directional terms, 35–36
 dissociation, 78–79, 98–99, 101, 113
 distal, 36, 98
 dowager's hump, 50, 91
 downward-collapsed (stooped) posture, 39, 50–51
 anterior torso compartment and, 165–166, 171, 184, 188, 190, 199
 hamstrings and, 142–143
 posterior lower-extremity compartment and, 121
 posterior torso compartment and, 171, 258, 261, 271
 draping, during bodywork, 248–249
 duration of treatment, 41

E
 edge
 definition of, 2, 112
 intensity levels, 110–112, 116
 edge of pain, 111
 edge technique, 2, 66, 79, 98, 108, 111–112

client to therapist communication in, 112–114
 neurofascial release using, 115
 warming up tissues and, 116
 education, client, 40, 48–49, 101, 108, 111
 efficient “good” posture, 50
 elastic cartilage, 28
 elasticity, 66, 115
 elbow joint, 22
 rotator imbalance, 45
 elbow muscles. *See* upper-extremity compartment
 elbow pain, 85–86, 312–337
 electrical (biochemical) tension, 62, 67–69, 72, 77, 115
 emergency care of acute injury, 368
 emotional factors
 in anterior torso work, 166
 in general tension, 62
 emotional stress, 78–79, 99, 109–110, 116, 367
 engrams, 4, 86, 89
 “entrapped” muscles, 205
 epicondyle, 11–12
 erector spinae muscle group, 260–262, 267, 357–358
 everter-inverter muscle groups, in ankle, 230
 exercise, tension accumulation and, 64
 expectations of client, 41
 extensibility, 116
 extensions (of bones), 12
 extrafusal fibers, 70, 72–74, 77
 eye level, compensatory actions maintaining, 54, 90, 171, 184, 199, 303

F
 facet, 12
 facet joint syndrome, 86, 282
 facial bones, 13–15
 facial expression, muscles of, 354
 facilitation
 law of, 67–69, 72, 74, 77, 79, 92, 93, 361
 segmental, 5
 false ribs, 19–20
 fasciae, 65
 versus muscle, 93–94, 115
 fascial stretching, in abdominal area, 171–172
 fear, 76, 99, 111
 feedback
 during and after bodywork session, 42, 46, 101, 114
 neuromuscular, Golgi tendon organs and, 106
 femoral nerve, 248
 femur, 25–26
 FHP. *See* forward head-neck posture
 fibrous cartilage, 28–29
 fibula, 26–27, 219, 230
 fight-or-flight response, 109, 111
 finger bones (phalanges), 23
 finger extensors, 331–334, 359
 finger flexors, 314–317
 finger pain, 322, 324, 337
 fissure (of bone), 12
 fitness, versus health, 67
 flexibility, degree of, 48, 64, 116
 floating ribs, 19–20
 foot bones, 27–28, 123–124
 foot disorders, 226, 230
 foot muscles, 123–124, 158, 221, 348, 355
 foot pain, 123–125, 138, 221–225, 228–229
 foramen, 11–12
 forearm bones, 22

forward head-neck posture (FHP), 39, 90
 anterior torso compartment and, 165, 199
 posterior torso compartment and, 282, 296, 303
 fossa, 11–12
 fovea, 11–12
 fright-or-freeze reaction, 109, 111
 frontal plane, 35, 39, 46
 frozen shoulder, 289
 functional imbalance. *See* structural imbalance
 functional kinesiology, 37, 45
 functional scoliosis, 53–54, 178

G
 gamma nerve system, 72, 102–103
 generalization, law of, 43, 104, 361
 GIGO (garbage in, garbage out), 70
 glenohumeral joint, 20–21, 292–293
 gluing, 93
 gluteal curve, 179
 golfer's elbow (medial epicondylitis), 317, 334
 Golgi tendon organs (GTOs), 70–71, 104–106
 perpendicular pressure and, 108
 tonus system and, 106
 goniometer, 44
 gravitational line, 46
 gravity
 physical relationship to, 34, 37, 39, 42–43, 50
 role in tension, 63
 greater trochanter, 150, 155
 groin pain, 243–244, 248
 GTOs. *See* Golgi tendon organs

H
 habituation (desensitization), 78–79, 98–99, 101, 113
 Hakomi body-centered psychotherapy, 78
 hamate, 22–23
 “hammer curl,” 321
 hammer toes, 225
 hamstring muscles, 140–142, 147, 237, 351
 shortening of, 39, 83, 142–143, 178–179, 199
 stretching of, 131–133, 159–160, 165, 171, 249
 treatment of, 122, 143–145
 hand bones, 23
 hand extensors, 331–334, 359
 hand flexors, 314–317
 hand grips, painful or weak, 312–313, 322
 hand pain, 85, 270, 292, 314–336
 hard-body mythology, 67
 head, postural balance of, 39, 48
 head (of bone), 11–12
 head pain
 anterior torso compartment and, 191–192, 195, 198–199, 207–209
 posterior torso compartment and, 259, 281–282, 294–295, 302–303, 305–306
 health, versus fitness, 67
 health status, assessment of, 40
 “heart attack muscle,” 184
 heel bone (calcaneus), 27–28, 125, 130, 225
 heel lifts, orthotic, 47
 heel pain. *See* plantar fasciitis
 herniation, 85
 Hilton's law, 264, 361
 “hip-click” phenomena, 178
 hip extensors, 146–151, 175, 241, 248, 356
 shortening of, 39, 44, 45, 47, 50, 51, 77, 85, 90, 165, 171, 179, 241, 261

stretching of, 160, 176–177, 241
treatment of, 151–152, 241–242
hip flexors, 175, 213–214, 241, 243–244, 248, 356
treatment of, 241–242, 244, 253–254
hip joint, 25–26, 155
hip pain, 151, 154, 156, 219, 240, 244, 247, 266–267
hip rotators, lateral, 153–157, 160–161, 357
history taking, 40–41
hold, 113
homeopathic interviewing, 41
homeostasis, 2, 39, 40, 74
structural, 87, 104–107
“home position” (point of reference), 44
horizontal plane, 35
hormesis, 110
Huber, Kelly, 363–366
humerus, 20–21
rotator imbalance, 45
hunchback, 50, 91
hyaline cartilage, 28
hyaluronic acid, 84
hydration, 84
hyoid bone, 14, 194–197, 199
hypolordosis, 39, 44

I
ice massage, 324
iliac crests, 24
as landmarks, 35, 47
iliolumbar ligaments, 85, 267
iliopsoas muscles, 174–178, 237, 241, 244, 250–251, 356
shortening of, 178
treatment of, 180–181
iliotibial band, 147, 241
iliotibial band syndromes, 237
ilium, 24–25, 155, 267
individualized focus of therapy, 3, 41, 43, 99–100
inferior, 36
infrahyoid muscles, 195–196, 199–200
inguinal ligament, 237, 248
inhibition, 65, 106
reciprocal, 77, 90
injuries, emergency care of, 368
innate intelligence, 363
insertion points of muscles, 11
intensity, law of, 361
interneurons, 65, 107
intervertebral disks, 17–18, 29
compression of, 85, 143, 165–166, 176–177, 184
interview, 40–42
intrafusal fibers, 72–74, 77
invasiveness, protective reaction against, 76, 99
ischemia, 361
ischial tuberosities, 24, 142, 147, 248
ischium, 24–25

J
jaw. *See* temporomandibular joint
Job’s Body (Juhan), 68, 70, 94
joint(s), 12, 28–29. *See also specific joint*
joint compression, 83–84
joint dehydration, 84
joint pain, 85
Juhan, Deane, 68, 70, 94

K
kinesiology, 37, 45
kinetic chain, 38, 39
knee disorders, 237–238
knee joint, 26–27
rotator imbalance, 45
knee muscles, 133–134, 140–142
knee pain, 219–220, 232–233, 236–237, 247
kyphosis, 91, 179

L
Langer lines, 172
lateral, 36
lateral epicondylitis (tennis elbow), 312–313, 317, 322, 324, 334
lateral hip rotators, 153–157, 160–161, 357
lateral malleolus, 27, 50, 219, 230
lateral menisci, 27
law of facilitation, 67–69, 72, 74, 77, 79, 92, 93, 361
law of generalization, 43, 104
laws of neurophysiology, 361. *See also specific law*
LeDoux, Joseph, 109
leg, versus thigh, 45
leg bones, 26–27
leg-length discrepancy, 38, 143, 156, 267
assessment of, 47, 143, 259
leg muscles
anterior, 127–130, 133–137, 355
posterior, 219–228, 349–350
treatment of, 226–227, 230–231
leg pain
anterior, 222, 228–229, 235, 247
posterior, 128–131, 134, 136–137, 150–151, 267
less, 112
ligaments, 28–29. *See also specific ligament*
tension in, 62–64
ligamentum nuchae, 282, 286, 296
line (of bone), 11–12
localized sensations, 101
lordosis, 91–92, 170
hypo-, 39, 44
lumbar, 51–52, 85, 171, 175–177, 179, 185
pseudo-, 177, 179, 261, 271
thoracic, 91
lower-back pain, 151, 156, 251, 267
lumbar curvature, 16, 48, 170, 175–176
flattening or loss of, 39, 44, 47, 50, 52, 90, 143, 171, 176–177, 179, 199
increase in, 51–52, 185, 261
lumbar lordosis, 51–52, 85, 171, 175–177, 179, 185, 261
lumbar support, 184–185
lumbar vertebrae, 15
compression of, 85, 165, 176–177
flexion/extension of, 176–177
lumbosacral sprain, 143
lunate, 22–23

M
magnetic resonance imaging (MRI), 364
mandible, 14. *See also* temporomandibular joint
manubrium, 18–19
massage therapy
chiropractic and, 363–366
overview of, 3
maximum edge, 110–112, 116

meatus, 11–12
medial, 36
medial epicondylitis (golfer’s elbow), 317, 334
medial malleolus, 27
medial menisci, 27
Meissner corpuscles, 107
menisci, 27
Merkel receptors, 107
metacarpals, 23
metatarsals, 27–28, 138
micro-dysfunction, 100
midbrain, 102–104, 106
midsagittal plane, 35, 46
migraine, 192
mind-body connection, 367
“mini” (pseudo)-lordosis, 177, 179, 261, 271
minimum edge, 110, 112, 116
moderate edge, 110, 112, 116
motor endplate, 4, 74
motor nerve pathways, 113
motor neurons, 65
motor plate, 67
motor units, 4, 70, 72, 74
movement
assessment using, 48
distorted, impact of, 77
forearm, 22–23
gravity and, 34, 37, 39, 42, 50
hand and wrist, 24
jaw, 14
knee, 24, 27
lower back, 17
neck, 15, 17
pelvic, 24
rib cage, 20
shoulder, 20–21
symmetry and, 37–38
synovial joints, 28–29
trunk, 20, 24
MRI (magnetic resonance imaging), 364
muscle(s)
agonist, synergist, and antagonist, 362
attachments of, 11
conscious control over, 72
dehydration and, 84
versus fascia, 93–94, 115
full body diagram, 346–347
opposing, pressure on, 87
during postural assessment, 35–36
relaxation of (*See* neuromuscular relaxation)
structure and function of, 60–61, 70–72
tears in, 70, 100
muscle compensation. *See* compensations
muscle fiber groups, pressure applied to, 100, 106, 108
muscle loading, 74
muscle spindles, 70–71
muscle tension
blood flow inhibited by, 87
chronic, 4, 61, 67–73
definition of, 62–63
focus of, 36, 39
general tension and, 62–64
pain caused by, 70
physiology of, 60–62
relative pulls of, 49–54
self-awareness of, 40, 45, 46, 48–49, 101–102, 116
symptoms and conditions, 83–84
volitional, 101–102

muscle tension release, 4–5, 65–68. *See also*
 neuromuscular relaxation; *specific condition being treated*
 client's role in, 101
 Golgi tendon organs and, 106
 mechanisms of, 101–103
 postural assessment and, 43
 pressure applied during (*See* pressure)
 principles of, 98
 reflexes and, 98–99
 table treatment, 48–49
 muscle tonus. *See* tonus
 muscular contraction, 60–61, 72
 all-or-none theory of, 74
 dehydration and, 84
 muscular imbalances
 assessment of, 35, 37–38, 47
 impact of, 39
 myofascia, 93–94, 115
 as focus of tension, 36, 39, 68, 78, 114, 264, 293
 myosin, 60–62, 70, 72, 84, 94, 116

N
 navicular bone, 27–28
 neck muscles. *See* cervical muscles
 neck pain, 191–192, 195, 198–199,
 198–200, 204
 anterior torso compartment and, 165–166, 171
 posterior torso compartment and, 294–296, 299
 nerve(s). *See also specific nerve*
 chiropractic and, 363–366
 compression or entrapment of, 86–87, 93, 166,
 204–205, 248, 312, 324, 361
 connection between muscles and, 4–5, 67–68
 as focus of therapy, 115
 structure and function of, 64–65, 67,
 72, 102–103
 synaptic potential, 68–69
 nerve excitation, chronic, 61–62
 neurofascial release, 115
 neuromuscular discoordination, 70, 93
 neuromuscular feedback, Golgi tendon organs
 and, 106
 neuromuscular junction, 4, 67–68
 neuromuscular reactions, 98–100
 neuromuscular reflexes, 74–77, 98–99
 neuromuscular relaxation, 61, 65–68, 72–73, 89.
See also muscle tension release
 for nerve compression, 86
 during stretching, 116
 using breathing, 49
 neuromuscular tension. *See* muscle tension
 neuromuscular therapy (NMT), 101, 102,
 103, 104
 neuromuscular tonus. *See* tonus
 neurophysiology, laws of, 361. *See also*
specific law
 neurotraps, 114–115
 Nimmo, Raymond, 103, 104
 nonsymmetrical work, 49

O
 obturator nerve, 248
 odontoid process (dens), 15
 opposing muscle, pressure on, 87
 origins of muscles, 11
 orthotic heel lifts, 47
 over-the-edge consequences, 112
 overuse injury, 88–89

P
 Pacinian corpuscles, 107
 pain. *See also specific site of pain*
 assessment of, 40
 edge of, 111
 joint, 85
 neuromuscular causes of, 70
 referred, 3, 86, 101
 therapeutic principles and, 109–111
 pain points, location of, 100–101
 palpation, in postural assessment, 35–38, 44, 46,
 47, 142, 364
 parasympathetic healing, 109–110
 pars vertebralis (psoas muscle), 177–178
 passages (of bones), 12
 passive movement, assessment using, 48
 patella, 26–27, 237
 fixation of, 219–220, 237
 patellar ligament, 27, 237
 patellar tendon reflex test, 75
 pectoral girdle, 19
 pelvic bones, 24–25
 pelvic curvature, 16, 48
 pelvic girdle, 10–11, 24–26
 pelvic pain, 175, 243–244, 267
 pelvic tilt
 anterior, 52–53, 77, 91, 179, 185
 assessment of, 43, 50, 52, 142–143
 lateral, 151, 156
 posterior, 142–143, 165, 171, 175–177, 199
 pelvis, proximation of rib cage and, 39, 44, 46–48,
 91, 165, 171, 199
 periosteal massage, 88
 periosteum, 28–29, 65
 irritation of, 87
 peripheral nervous system, 65, 89, 107
 peroneal muscles, 219, 227–231
 perpendicular pressure, 108
 pes anserinus, 248
 Pfluger's laws, 361
 phalanges (finger and toe bones), 23, 27–28,
 123–124, 138
 physical stress, 78, 99
 pisiform, 22–23
 plan of treatment, 40, 46
 planes of reference, 35
 plantar fasciitis, 122, 125–127, 131
 PLEC. *See* posterior lower-extremity
 compartment
 point of reference (“home position”), 44
 “poor posture muscle,” 184
 popliteal artery, 134
 positional terms, 35–36
 positioning, during table assessment, 47
 posterior compartment muscles, 165
 posterior lower-extremity compartment (PLEC),
 120–163, 348–351
 buttocks (*See* buttocks)
 case study, 122
 deep posterior compartment,
 135–139, 350
 foot, 123–127, 348
 hamstring group (*See* hamstring muscles)
 knee, 133–134
 lateral hip rotators, 153–157,
 160–161, 357
 leg, 127–133, 349–350
 stretching exercises, 158–161
 posterior suboccipitals, 301–304
 posterior superior iliac spines (PSIS), 24, 142

posterior torso compartment (PTC), 219,
 257–310, 357–358
 case study, 259
 cervical muscles (*See* cervical muscles)
 deep paraspinals, 263–265, 357–358
 effect of stooped posture on, 171, 176, 258
 erector spinae group, 260–262, 267, 357–358
 latissimus dorsi, 269–273, 357, 360
 occipitals, 301–306
 quadratus lumborum, 266–269, 358
 rhomboids, 285–287, 357
 rotator cuff (*See* rotator cuff)
 stretching exercises, 306–308
 teres major, 274–276, 357, 360
 trapezius, 281–284, 357
 posterior view, 35–36
 postoperative scar tissue, in abdominal area,
 171–172
 postural assessment, 2, 34–38
 client interaction, 40–42
 common elements of, 46
 techniques, 42–48, 142–143
 postural distortions, 361, 363–364
 assessment of, 35, 37–38, 47, 258
 bilateral (front and back), 271
 fasciae and, 93–94
 forward head-neck (*See* forward head-neck
 posture)
 impact of, 39, 77
 stooped (*See* downward-collapsed posture)
 swayback, 219
 types of, 50–51
 unilateral (side to side), 271
 upward elevated (arched), 51–53, 258, 261, 282
 postural kinesiology, 37, 45
 posture, 49–54
 efficient “good,” 50
 during sleep, 241, 290, 296
 potential, synaptic, 68–69
 pressure
 constant relative, 108
 edge technique and, 111
 perpendicular, 108
 slow, steady, 100–101
 tonus system and, 106–107
 primary contractors, 2
 prime mover (agonist) muscle, 362
 processes (of bone), 11–12, 17
 projections (of bones), 12
 pronation (arm), 22–23
 prone, 36
 protective mechanisms, 76, 99
 protuberance, 12
 proximal, 36
 pseudo-arthritis, 85
 pseudo-lordosis, 177, 179, 261, 271
 pseudo-scar tissue, 93
 PSIS (posterior superior iliac spines), 24, 142
 psychoemotional factors, in general tension, 62
 psychoemotional stress, 78–79, 99, 109, 116, 367
 psychotherapy, 78
 PTC. *See* posterior torso compartment
 pubic symphysis, 24–25, 29
 pubis, 24–25, 243, 248

Q
 quadriceps femoris, 26, 83, 232–237, 356
 dysfunction of, 237–238
 stretching of, 249
 treatment of, 238–239

R

radial nerve, 322, 324
radiation, law of, 361
radiation sensation, 101
radiography (x-rays), 364
radius, 22
range-of-motion assessment, 48
Receptor-Tonus Technique, 103, 361
reciprocal inhibition, 77, 90
referral sensations, 3, 86, 101
reflexes, neuromuscular, 74–77, 98–99
reflexive release, 102–103
rehabilitation stages, injured soft tissue, 368
relational yoga, 2
relaxation, neuromuscular. *See* muscle tension release; neuromuscular relaxation
relaxed standing position, 43
Renshaw cells (corpuscles), 107
repetitive action
 temporal summation through, 69
 tension caused by, 70–71
repetitive strain injury, 88–89, 317, 322, 334
resistance, 111–112
respiratory muscles, 278–280
response time, 92–93
resting tonus, 66–67, 74, 77, 82, 89, 92
reticular formation, 43, 78, 103, 106
retinaculum, 22, 27–28
rib cage, 18–20, 29, 184
 arching posture and, 261, 282
 proximation of pelvis and, 39, 44, 46–48, 91, 165, 171, 199
RICE (rest, ice, compression, elevation), 368
rotations, 37, 45, 46
rotator cuff, 287–293
 bony landmarks for, 36, 289
 injuries to, 271, 289–290
 referred pain from, 312
 treatment of, 290–291, 293, 340
Rotella, Robert J., 367
roto-scoliosis, 264
Ruffini corpuscles, 107

S

sacral ligament sprain, 143
sacroiliac joint, 24
sacrum, 15–16
sagittal plane, 35
scalenes, 203–206, 312, 317
scaphoid bone, 22–23
scapula (shoulder blade), 19–21, 329
scar tissue, 93, 366
 postoperative, in abdominal area, 171–172
sciatica, 86, 151
sciatic nerve, 248
scoliosis, 53–54, 89–90
 leg-length discrepancy and, 143, 156, 259, 267
 lumbar pain pattern and, 178
 occipital shortening and, 303
 roto-, 264
 S-curved, 53–54, 259
 treatment of, 86, 90
“seated-chair client,” 77, 171, 176, 178, 184–185, 241
secondary contractors, 2
segmental facilitation, 5
self-awareness
 of edge, 112
 of muscle tension, 40, 45, 46, 48–49, 101–102
 reclaiming, 113–114, 116

Selye, Hans, 78
sensation, as therapy tool, 106–107
sensory nerve pathways, 65, 113
shin splints, 131
shoulder(s)
 elevation of, 282, 299
 rounding of, 184, 188
shoulder blade (scapula), 19–21, 329
shoulder girdle, 10–11, 19, 20–21. *See also* rotator cuff
 assessment of, 35, 48
 muscular tension in, blood supply inhibited by, 87
shoulder muscles
 anterior, 182–184, 187–188
 treatment of, 185–187, 189
 posterior, 270–272, 274–275, 281–282, 285–286
 stretching of, 308
 treatment of, 215, 272–273, 275–276, 283–284, 286–287
shoulder pain
 anterior torso compartment and, 182–183, 184
 posterior torso compartment and, 270, 272, 274–275, 278, 281–282, 285–286, 288–290, 292–293, 299
 upper-extremity compartment and, 312, 326, 328, 336, 340
SITS muscles. *See* rotator cuff
sitting, long-term impact of, 77, 171, 176, 178, 184–185, 241
skeletal compensation. *See* compensations
skeletal deviations, 37
skeleton, 10–11
 connectors of, 28–29
skull, 13–15
sleeping position, 241, 290, 296
slouching, impact of, 74–75, 77, 91, 171, 176
slower, 113
soft-look assessment, 43
soft tissue, rehabilitation stages, 368
somatic nerves, 5
spatial summation, 68–69
spinal curvature, 16, 48. *See also specific vertebral section*
 flattening or loss of, 39, 44, 47
spinal disks, 17–18, 29
 compression of, 85, 143, 165–166, 176–177, 184
spinal facet joint dysfunction, 282
spinal instability, 282
spinal manipulation, 264, 268
spinal muscles, attachment of, 17
spinal stabilizers, 175–176
spine (vertebral column), 15–18, 358
 misalignment of, 363–366 (*See also* postural distortions)
spines (of bone), 11–12
spinous processes (vertebral), 17–18
standing position, relaxed, 43
static stretching, 115
static tension, 62
sternal body, 18–19
sternoclavicular joint, 19–20
sternum (breastbone), 18–20, 29
stiff-neck pain, 296, 299
stooped posture. *See* downward-collapsed posture
stop, 113
straight leg stretch exam, 143
stress

 physical, 78, 99
 psychoemotional, 78–79, 99, 109–110, 116, 367
stressors, 78–79, 109
stretching, 64, 66–67, 69
 anterior lower-extremity compartment, 252–254
 anterior torso, 213–215
 hamstring, 131–133
 posterior lower-extremity, 158–161
 posterior torso compartment, 306–308
 proper technique for, 116
 static, 115
 upper-extremity compartment, 342–343
stretch reflex, 75, 77, 98
structural analysis, 2, 34, 37, 38
 general tension and, 62
structural homeostasis, 87, 104–107
structural imbalance
 assessment of, 35, 37–38, 47
 fasciae and, 93–94
 impact of, 39
 types of, 50–51
structural scoliosis, 53–54, 178
subconscious processes, 101–102, 106, 113, 116
subluxation, 85, 363–366
suboccipitals, posterior, 301–304
subtle reflexes, 77
sulcus, 12
summation, temporal versus spatial, 68–69
superficial, 36
superior, 36
supination (arm), 22–23
supine, 36
suprahyoid muscles, 194, 199–200
surface features of bones, 11–12
 as landmarks, 36–37, 47
sutures, 13
swayback posture, 219
Swedish massage, 3
symmetry, 35, 37
 law of, 361
sympathetic nervous system, 109
synapses, 4
 chemical modification of, 62, 67–69, 72, 77, 115
synaptic potential, 68–69
The Synaptic Self (LeDoux), 109
synchronization of motor units, 70
synergist muscle, 362
synovial capsule, 27, 29
synovial fluid, 20, 28, 29, 84
synovial joints, 28–29

T

table
 assessment on, 47–48
 treatment on, 48–49
tailbone (coccyx), 15–16, 147
“tailor muscle” (sartorius), 237
talus, 27–28, 230
tarsal bones, 27–28, 138
temporal summation, 68–69
temporomandibular joint (TMJ), 14, 354
 dysfunction of, 210
 treatment of, 211–213
tendon(s), 28–29, 63. *See also specific tendon*
 Golgi tendon organs in, 70–71, 104–106
 as landmarks, 37
 massage of, 88
 tension in, 62–64

tendonitis, 87, 88, 131
 tennis elbow (lateral epicondylitis), 312–313, 317, 322, 324, 334
 tension
 fascial, 36, 39, 68, 78, 94, 114, 264
 general, 62–64
 muscle (See muscle tension)
 thalamus, 103–104
 thigh, versus leg, 45
 thigh bones, 26–27
 thigh muscles, 140–141, 219, 351, 356. *See also* adductor group; hamstring muscles; quadriceps femoris
 stretching of, 159–160
 treatment of, 122, 143–145
 thigh pain, 141, 151, 232–237, 245–248, 246–248
 thixotropy, 84, 93, 94
 thoracic curvature, 16, 48
 loss of, 52, 261, 271
 thoracic kyphosis, 179
 thoracic lordosis, 91
 thoracic outlet syndrome, 184, 289
 thoracic rib cage, 19–20
 thoracic vertebrae, 15, 20
 thumb, 23–24
 thyroid cartilage, 195–196, 199
 tibia, 26–27, 225, 237
 tibial nerve, 134
 tibial tuberosity, 27, 237
 tilts, 37
 time factors, during therapy, 115
 TMJ. *See* temporomandibular joint
 toe bones (phalanges), 27–28, 123–124, 138
 toe disorders, 225
 toe pain, 222, 224, 225
 tonus, 64–65, 73, 361
 aging and, 92
 resting, 66–67, 74, 77, 82, 89, 92
 versus tone, 64, 66, 92

tonus system, 43, 103–104
 Golgi tendon organs and, 106
 torso
 anterior (See anterior torso compartment)
 posterior (See posterior torso compartment)
 transverse plane, 35, 47–48
 transverse processes (vertebral), 17–18, 20
 trapezium, 22–23
 trapezoid, 22–23
 trauma, as source of tension, 79, 99, 107, 109–110, 112, 364
 Travell, Janet, 90, 101, 184, 204
 treatment plan, 40, 46
 trigger point(s), 101, 102, 361
Trigger Point Manual (Travell), 90
 triquetrum, 22–23
 trochanter, 11–12
 trochlear notch (ulna), 22
 true ribs, 19
 trunk flexors, 170
 shortening of, 171, 176, 261
 tubercle, 11–12
 tuberosity, 11–12
 ischial, 24, 142, 147, 248
 tibial, 27, 237
 twists, 37

U

ulna, 22
 unconscious processes, 101–102, 106, 113, 116
 unilaterality, law of, 361
 upper-extremity compartment (UEC), 311–345, 358–359
 biceps brachialis, brachialis and coracobrachialis, 326–331, 360
 brachioradialis, 320–322, 360
 case study, 313
 deltoids, 339–341, 357, 360
 extensors of wrist/hand/fingers, 331–335, 359

flexors of hand/wrist/fingers, 314–317
 pronator teres, 319–320
 referral sensations, 312
 stretching exercises, 342–343
 supinator, 323–325, 359
 triceps brachii and anconeus, 336–338, 359–360
 upward elevated posture, 51–53

V

vagus nerve irritation, 87
 Vannerson, James, 103, 104
 vertebral column, 15–18, 358
 misalignment of, 363–366 (*See also* postural distortions)
 vertical line, 50
 visceral nerves, 5
 volitional release, 101–102

W

warming tissues for treatment, 67, 116
 warming up. *See* stretching
 water, body, 84
 whiplash injury, 200, 296, 303
 withdrawal reflex, 75–76, 99
 wrist bones, 22–23
 wrist extensors, 331–334, 359
 wrist flexors, 314–317
 wrist pain, 312, 314–316, 319, 321–322, 327, 332–334

X

xiphoid process, 18–20
 x-rays (radiography), 364

Y

yoga, relational, 2

Muscle Index

Page numbers in **bold** indicate major discussion and figures

Page numbers in *italics* indicate routines.

Abductor digiti minimi	124, 126–127	Pectineus	237, 241, 242–243 , 244
Abductor hallucis	124, 126–127	Pectoralis major	165, 171, 181–182 , 185–187, 271, 275, 329
Adductor brevis	246–247 , 249–250	Pectoralis minor	165, 171, 181–183 , 185–187, 329
Adductor longus	246–247 , 249–250	Peroneus brevis	228 , 230–231
Adductor magnus	147, 176, 179, 245–246 , 249–250	Peroneus longus	227–228 , 230–231
Anconeus	324, 336–337 , 338	Peroneus tertius	229 , 230–231
Biceps brachii	292, 312–313, 324, 326 , 329–331	Piriformis	151, 153 , 156–157
Biceps femoris	140–141 , 144–145	Plantaris	129–130 , 131–133, 134
Brachialis	312–313, 324, 327 , 329–331	Popliteus	122, 133–134 , 134
Brachioradialis	313, 320–321 , 322–323, 324	Pronator teres	319 , 320, 324
Coracobrachialis	328 , 329–331, 339	Psoas major	77, 85, 165, 174–175 , 180–181, 251 , 267
Deltoid	329, 339–340 , 340–341	Psoas minor	174–175, 251
Digastric	194 , 200–202	Quadratus femoris	26, 154 , 156–157, 219
Erector spinae	52, 86, 90, 91, 147, 260 , 262, 267, 271, 282	Quadratus lumborum	36, 45, 46, 47, 90, 147, 178, 259, 261, 266 , 268–269, 271
Extensor carpi radialis brevis	322, 332 , 334–335	Quadratus plantae	125
Extensor carpi radialis longus	322, 331 , 334–335	Rectus abdominis	77, 85, 90, 167–168 , 172–173, 176
Extensor carpi ulnaris	322, 333–334 , 334–335	Rectus capitis posterior major	301–302 , 304
Extensor digitorum brevis	221 , 226–227	Rectus capitis posterior minor	301 , 303 , 304
Extensor digitorum longus	224 , 226–227	Rectus femoris	232 , 238–239, 241
Extensor hallucis longus	223 , 226–227	Rhomboids	188, 259, 263–264, 282, 285 , 286–287
External oblique	77, 85, 90, 167–168 , 172–173, 176, 188	Rotatores	147, 176, 263–264 , 264–265
Flexor carpi radialis	314 , 317–318	Sartorius	236 , 238–239, 241, 248
Flexor carpi ulnaris	315 , 317–318	Scalenus anterior	203–204 , 205–206, 312, 317
Flexor digitorum brevis	123 , 126–127, 131	Scalenus medius	203–204 , 205–206, 312, 317
Flexor digitorum longus	135 , 138–139	Scalenus posterior	203–204 , 205–206, 312, 317
Flexor hallucis longus	136 , 138–139	Semimembranosus	140–141 , 144–145
Gastrocnemius	4, 122, 125, 127–128 , 131–133, 138, 230	Semitendinosus	140–141 , 144–145, 237, 248
Gemellus inferior	155 , 156–157	Serratus anterior	165, 171, 184, 185, 187–188 , 189, 282
Gemellus superior	154 , 156–157	Serratus posterior inferior	261, 277, 279
Geniohyoid	195 , 200–202	Serratus posterior superior	278 , 280, 282
Gluteus medius	148–149 , 151–152, 155, 176, 241	Soleus	122, 125, 128–129 , 131–133, 138, 230
Gluteus maximus	77, 86, 146 , 147–148, 151, 176, 179, 237, 241	Splenius capitis	259, 295 , 296–298
Gluteus minimus	77, 86, 149–150 , 151–152, 155, 176, 241	Splenius cervicis	259, 294 , 296–298, 299
Gracilis	237, 246 , 249–250	Sternocleidomastoid	190–191 , 192–193
Iliacus	174–175 , 180–181, 251	Sternohyoid	195–196 , 200–202
Infraspinatus	36, 288 , 290–291	Sternothyroid	195–196 , 200–202
Internal oblique	77, 85, 90, 168–169 , 172–173, 176	Stylohyoid	195–196 , 200–202
Lateral pterygoid	209–210 , 211–213	Subclavius	182–183 , 185–187
Latissimus dorsi	45, 91, 176, 184, 185, 261, 267, 269–270 , 272–273, 275, 282, 286, 337	Subscapularis	185, 271, 275, 289, 291–292 , 293, 312, 317, 337
Levator scapulae	188, 259, 282, 298–299 , 299–301	Supinator	322, 323–324 , 325, 329
Longus capitis	198–199 , 200–202	Supraspinatus	36, 287–288 , 290–291, 339
Longus colli	197–198 , 200–202	Temporalis	208 , 211–213
Masseter	206–207 , 211–213	Tensor fasciae latae	151, 219, 237, 240 , 241–242
Medial pterygoid	209 , 211–213	Teres major	185, 271, 274 , 275–276, 337
Multifidus	147, 263–264 , 264–265	Teres minor	288–289 , 290–291
Mylohyoid	194 , 200–202	Thyrohyoid	195–196 , 200–202
Obliquus capitis inferior	301 , 304	Tibialis anterior	222 , 226–227
Obliquus capitis superior	301 , 304	Tibialis posterior	137 , 138–139
Obturator externus	45, 153 , 156–157, 267	Transverse abdominis	85, 168–170 , 172–173
Obturator internus	45, 155 , 156–157, 267	Trapezius	188, 191, 259, 271, 281 , 283–284, 286, 289
Occipitalis	305 , 306	Triceps brachii	324, 336 , 338, 339
Omohyoid	195 , 197 , 200–202	Vastus intermedius	233–234 , 238–239
Palmaris longus	316 , 317–318	Vastus lateralis	233–235 , 238–239
		Vastus medialis	233 , 238–239

STRUCTURAL BALANCING

A CLINICAL APPROACH

by Kyle Wright advances the reader's clinical knowledge and hands-on skills of trigger point therapy techniques, postural and body structural conditions that cause chronic pain and discomfort, and specific therapies and exercises for resolving those conditions. Appropriate for clinical courses in massage therapy, physical therapy, and chiropractic programs, this text provides a step-by-step illustrated guide of manipulations for easy learning of muscle pains and their causes. Content is practical and treatment specific, discussing muscle attachments, pain patterns, clinical notes, range-of-motion exercises, physical distortions, and proper positioning. Structural Balancing teaches employable skills for a variety of healthcare specialties.

Additional Massage Therapy Titles by McGraw-Hill:

Saeger/Kyle-Brown, New Foundations in Therapeutic Massage & Bodywork, ©2008
0-07-302582-8

Jurch, Clinical Massage: Assessment & Treatment of Orthopedic Conditions ©2009
0-07-351093-9

Watson/Voner, Practical Reflexology: Interpretation and Techniques ©2009
0-07-351095-5

Dail/Agnew/Floyd, Kinesiology for Manual Therapies ©2011
0-07-340207-9

Abbott, Massage Therapy Review: Passing the NCETMB, NCETM, and MBLEx ©2011
0-07-809391-0

Saeger/Rudolph, Building a Healthy Business: For Massage and Alternative Healthcare Practices ©2010
0-07-340191-9

The McGraw-Hill Companies



ISBN 978-0-07-337392-8
MHID 0-07-337392-3



www.mhhe.com